PB83-169466

Supplemental Draft Environmental Impact Statement Dolet Hills Lignite Mine Project De Soto Parish, Louisiana (A Supplement to the Dolet Hills Power Plant EIS)

(U.S.) Environmental Protection Agency
Dallas, TX

Feb 83

U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Region 6
1201 Elm Street
Dallas TX 75270

EPA 906/9-83-001
February 1983

Water

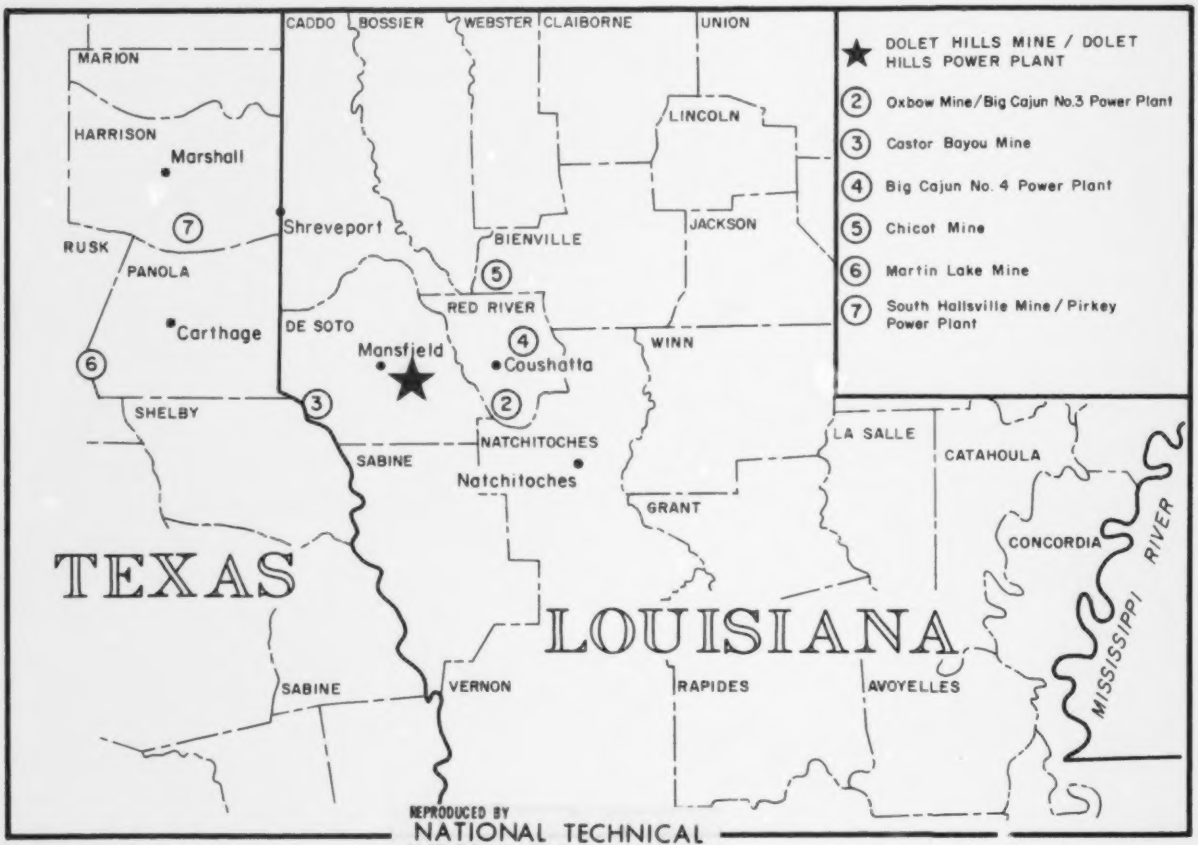
PB83-169466

EPA

Environmental Impact Statement

Supplemental Draft

Dolet Hills
Lignite Mine Project
De Soto Parish, Louisiana
(A Supplement to the Dolet Hills Power Plant EIS)


★ DOLET HILLS MINE / DOLET HILLS POWER PLANT
② Oxbow Mine/Big Cajun No.3 Power Plant
③ Castor Bayou Mine
④ Big Cajun No. 4 Power Plant
⑤ Chicot Mine
⑥ Martin Lake Mine
⑦ South Hallsville Mine / Pirkey Power Plant
CADDO
BOSSIER
WEBSTER
CLAIBORNE
UNION
MARION
HARRISON
Marshall
LINCOLN
JACKSON
RUSK
PANOLA
Shreveport
BIENVILLE
RED RIVER
DE SOTO
Carthage
Mansfield
Coushatta
WINN
SHELBY
SABINE
NATCHITOCHES
Natchitoches
LA SALLE
CATAHOULA
GRANT
CONCORDIA
TEXAS
LOUISIANA
MISSISSIPPI RIVER
SABINE
VERNON
RAPIDES
AVOYELLES

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	**2.**	**3. RECIPIENT'S ACCESSION NO.** PB83 169466
4. TITLE AND SUBTITLE Supplemental Draft EIS, Dolet Hills Lignite Mine Project, De Soto Parish, Louisian, (A Supplement to the Dolet Hills Power Plant EIS)		**5. REPORT DATE** February 1983 **6. PERFORMING ORGANIZATION CODE** EPAEMA
7. AUTHOR(S) Numerous		**8. PERFORMING ORGANIZATION REPORT NO.** 906/9-83-001
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Environmental Protection Agency, Region 6 1201 Elm St. Dallas, TX 75270		**10. PROGRAM ELEMENT NO.** A7VB2G **11. CONTRACT/GRANT NO.**
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency, Region 6 1201 Elm St. Dallas, TX 75270		**13. TYPE OF REPORT AND PERIOD COVERED** Supplemental Draft EIS **14. SPONSORING AGENCY CODE**

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This Supplemental Draft Environmental Impact Statement (Draft SEIS) has been prepared as part of the "teiring" concept, and is intended to supplement the Dolet Hills Power Plant Project Draft EIS and Final EIS in which Southwestern Electric Power Company (SWEPCO) and Central Electric Power Company, Inc. (CLECO) evaluated alternative power plant designs and mine-mouth siting options around a 211.1 million ton lignit reserve. In this supplement, the Dolet Hills Mining Venture has applie to EPA for a NPDES permit as the mining contractor/operator of a 11,168 hectare (29,573 acre) surface lignite mine and related ancillary facili ties. EPA is considering the issuance or denial of the NPDES permit fo the alternatives evaluated, including no action. Land use, water resources, mining and reclamation are among the more important areas of concern that are considered in this statement.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

18. DISTRIBUTION STATEMENT Release to Public	**19. SECURITY CLASS** *(This Report)* unclassified	**21. NO. OF PAGES** 357
	20. SECURITY CLASS *(This page)* unclassified	**22. PRICE**

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

United States
Environmental Protection
Agency

Region 6
1201 Elm Street
Dallas TX 75270

EPA 906/9-83-001

February 1983

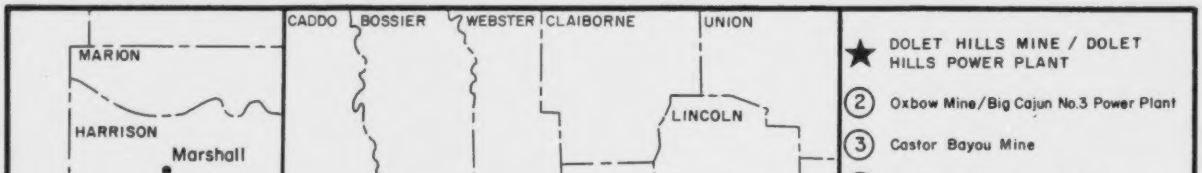
Water

EPA

Environmental Impact Statement

Supplemental Draft

Dolet Hills Lignite Mine Project De Soto Parish, Louisiana (A Supplement to the Dolet Hills Power Plant EIS)


CADDO
BOSSIER
WEBSTER
CLAIBORNE
UNION
MARION
HARRISON
Marshall
LINCOLN
RUSK
Shreveport
BIENVILLE
JACKSON
PANOLA
Carthage
DE SOTO
RED RIVER
Mansfield
Coushatta
WINN
SHELBY
SABINE
NATCHITOCHES
Natchitoches
LA SALLE
CATAHOULA
GRANT
CONCORDIA
TEXAS
LOUISIANA
SABINE
VERNON
RAPIDES
AVOYELLES
MISSISSIPPI RIVER
★ DOLET HILLS MINE / DOLET HILLS POWER PLANT
② Oxbow Mine/Big Cajun No.3 Power Plant
③ Castor Bayou Mine
④ Big Cajun No. 4 Power Plant
⑤ Chicot Mine
⑥ Martin Lake Mine
⑦ South Hallsville Mine / Pirkey Power Plant

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

January 19, 1983

TO ALL INTERESTED AGENCIES, PUBLIC GROUPS AND OFFICIALS:

EPA determined that the decision on its National Pollutant Discharge Elimination System (NPDES) permit for wastewater discharge from the proposed Dolet Hills Lignite Mine represented a major action significantly affecting the quality of the human environment, and has prepared this Supplemental Draft Environmental Impact Statement (SEIS).

Comments on the Draft SEIS should be sent to Mr. Clinton B. Spotts, Regional EIS Coordinator, EPA, Region 6, 1201 Elm Street, Dallas, Texas 75270. Substantive comments received on the Draft SEIS will be considered in the preparation of the Final SEIS.

It is requested that comments on the Draft EIS be submitted within 45 days of the publication in the Federal Register of the Notice of Availability of the Draft SEIS by the EPA, Office of Federal Activities.

It should be noted that if changes to the proposed project and Draft SEIS are minor, the Final SEIS will consist primarily of: (1) the summary, (2) pages in the text with changes necessitated in response to comments on the Draft SEIS, and (3) the coordination section with EPA responses to comments received on the Draft SEIS. Therefore, the Draft SEIS should be retained.

EPA will hold a public hearing on the Draft SEIS at the following location:

DeSoto Parish Instructional Material Center,
on Oxford Road in Mansfield, Louisiana, at
7:30 p.m., on Tuesday, March 15, 1983.

The Final SEIS will be sent only to agencies and interested parties who request a copy or make substantive comments of the Draft SEIS.

Sincerely yours,

Frances E. Phillips
Dick Whittington, P.E.
Regional Administrator

Enclosure

SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT
DOLET HILLS LIGNITE MINE PROJECT
DE SOTO PARISH LOUISIANA
(A SUPPLEMENT TO THE DOLET HILLS POWER PLANT EIS)

Responsible Agency:	U.S. Environmental Protection Agency, Region 6
Action being considered:	Issuance of a new source National Pollutant Discharge Elimination System (NPDES) permit to the Dolet Hills Mining Venture (DHMV), for construction and operation of a surface lignite mine in De Soto Parish, Louisiana.
Cooperating Agencies:	U.S. Army Corps of Engineers New Orleans District Fort Worth District U.S. Department of the Interior Office of Surface Mining Fish and Wildlife Service National Park Service U.S. Department of Agriculture Soil Conservation Service Federal Emergency Management Agency State of Louisiana Office of Conservation Office of Public Works Office of Program Development Office of State Parks Office of Agricultural and Environmental Sciences Office of Commerce and Industry

Contact for further information:

Clinton B. Spotts, Regional EIS Coordinator

U.S. Environmental Protection Agency,
Region 6 (ES-F)
1201 Elm Street, Suite 2800
Dallas, Texas 75270

Phone: Commercial (214) 767-2716
FTS 729-2716

Abstract:

This Supplemental Draft Environmental Impact Statement (Draft SEIS) has been prepared as part of the "tiering" concept, and is intended to supplement the Dolet Hills Power Plant Project Draft EIS and Final EIS in which Southwestern Electric Power Company (SWEPCO) and Central Louisiana Electric Company, Inc. (CLECO) evaluated alternative power plant designs and mine-mouth siting options around a 211.1 million ton lignite reserve. In this supplement, DHMV has applied to EPA for a NPDES permit as the mining contractor (operator) for construction and operation of a 11,968-hectare (29,573-acre) surface lignite mine and related ancillary facilities consisting of a main office, field workshops, dragline erection areas, a conveyor system, haul roads, sedimentation ponds, and stream and runoff diversion structures. DHMV proposes to extract 141.1 million tons of lignite (at a peak production rate of 5.64 million tons per year) for 32 years. EPA is considering the issuance or denial of a new source NPDES permit for the alternatives evaluated, including no action. Land use, water resources, mining and reclamation are among the more important areas of concern that are considered in this statement.

Date Comments due:

Responsible Official:

Frances E. Phillips

Dick Whittington, P.E.
Regional Administrator

1.0 SUMMARY

1.1 BACKGROUND

The National Environmental Policy Act of 1969 (NEPA) requires that all Federal agencies prepare environmental impact statements on major actions significantly affecting the quality of the human environment. Furthermore, Section 511(c)(1) of the Federal Water Pollution Act (FWPCA or P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-217) mandates that the requirements of NEPA apply to issuing a permit under Section 402 of FWPCA for discharging any pollutant by a "New Source" as defined in Section 306 of FWPCA. The Environmental Protection Agency (EPA) determined that the issuance of a New Source NPDES permit to the Dolet Hills Mining Venture for the first 5-year period of the proposed Dolet Hills Lignite Mine Project, a surface lignite mine operation which will fuel the Dolet Hills Power Plant, represented a major Federal action significantly affecting the quality of the human environment. Therefore, this supplemental draft environmental impact statement (SEIS) is prepared to assess the impacts of EPA's New Source NPDES permit actions, and to supplement the Dolet Hills Power Plant Project Draft EIS (EPA, 1981).

1.2 ALTERNATIVES

Taking no action was evaluated, in addition to numerous mine and transportive systems designs and alternative energy sources. Energy sources such as geothermal, solar, wind, coal, and petroleum gasification, natural gas, and western coal were evaluated and eliminated as being technologically infeasible at present, or not cost-effective (EPA, 1981). Lignite extraction alternatives that were considered included underground mining, auger mining, and surface mining. All operating lignite mines in the United States are surface mined, and this method was selected as the preferred alternative for the proposed mine. Other mine operation alternatives for the major components of a surface mine were considered, including overburden removal and handling techniques, lignite loading, lignite transportation, and reclamation.

Alternatives available to the EPA are to issue the NPDES permit for the project, to issue the NPDES permit for the project with certain conditions to minimize or alleviate adverse impacts, or to deny the permit.

1.3 PROPOSED PROJECT

The proposed Dolet Hills Lignite Mine Project will be located approximately 10 kilometers (6.2 miles) southeast of Mansfield, Louisiana. The area to be mined contains an estimated 141.1 million recoverable tons of lignite. The mine should produce 4.4 million tons of lignite (average) per year, with maximum production reaching 5.64 million tons per year. The mine will be operated for SWEPCO/CLECO by DHMV. The proposed mine permit area encompasses 11,968 hectares (29,573 acres). Of this total, 6,259 hectares (15,466 acres) will be directly affected by mining during the 32-year life of the mine (1985-2017). Road construction will affect 70.8 hectares (175 acres), 65.5 hectares (162 acres) will be affected by the lignite conveyor system, 72.8 hectares (180 acres) will be affected by mine facilities, 27.6 hectares (68 acres) will be affected by permanent sedimentation ponds, 11.3 hectares (27.8 acres) will be affected by stream diversions outside the mining blocks, and dragline erection will disturb 4.5 hectares (11 acres). An average of 195 hectares (483 acres) will be mined on an annual basis for the life of the mine. The average number of hectares per year that will be disturbed by clearing, mining, and reclamation will be 280.5 hectares (693 acres). The maximum number of hectares that will be ungraded (disturbed or exposed) per year (2001-2008) will be approximately 486 hectares (1,200 acres).

The proposed mine will use conventional single-seam mining procedures. In certain small areas, a second upper lignite seam may be mined where feasible and economical. Timber and other vegetation will be removed prior to mining. Where the lignite is equal to or less than 21 meters (70 feet) below the surface, draglines will be used to remove the overburden. At depths greater than 21 meters (70 feet), bucket-wheel excavators and/or scrapers will be used to prestrip the overburden down to a 21-meter (70-foot) bench above the lignite. A dragline will then operate off the bench to excavate the remaining overburden.

Once the lignite is exposed, hydraulic backhoes or continuous miners will excavate the lignite. It will then be loaded onto 70-ton dump trucks. The trucks will transport the lignite to a loading hopper where it will be transported to the Dolet Hills Power Plant via a conveyor system.

Road construction in the permit area will consist of building lignite haul roads from the mining pits to the conveyor system loading hopper, access roads, and temporary access roads. When the roads are no longer needed, the surface will be regraded and reclaimed to an approved postmining land use.

Mine facilities will consist of a main office block, field workshop facilities, and dragline erection sites. The main office block will house management, engineering, and other personnel. It will consist of several office buildings, workshop, warehouse, store yard, automobile and mine vehicle parking, water and fuel storage area, and sewage treatment facilities. The two field workshop facilities will consist of a workshop, store yard, wash pad, mine vehicle parking area, fuel storage, and sewage treatment facilities. Sewage treatment units will be installed at the main and field offices, and will be packaged extended aeration units with secondary treatment. Water from vehicle washing will be treated in an oil separator before discharge to a sedimentation pond. All discharges will meet EPA NPDES permit limitations for conventional pollutants.

Throughout the life of the mine, temporary and permanent sedimentation ponds will be constructed to receive and detain runoff from disturbed areas. In addition, a series of temporary and permanent ditches and diversion structures will be installed to control surface water runoff. The ditches will consist of two types: upstream interceptor ditches and sediment diversion ditches. Upstream interceptor ditches will be used to direct drainage from undisturbed areas away from disturbed areas to prevent co-mingling of drainage. Sediment diversion ditches will direct runoff from disturbed areas to sediment control structures.

Levees will be necessary to prevent flooding caused by backwater when mining near Buffalo, Mundy, and San Patricio bayous in the west area, and near West Branch Dolet, Dolet, Prairie, and Louies bayous in the east area, and several smaller streams in the proposed project area. Overland flood control measures will be implemented to prevent runoff from entering active mine pits. Runoff toward the mine pit will be diverted around the pit, or in cases where diversion channel excavations would be too great, catchment basins will be formed by temporary dikes to keep water out of the pit. The overland flow diversions will be necessary to direct runoff from disturbed areas to sedimentation ponds.

Overburden handling will be as follows: where suitable sandy material occurs above the lignite, it will be selectively placed on the surface wherever possible. Where this is not possible, near-surface oxidized overburden will be placed on the surface. Both have been judged to be satisfactory medium for pine seedling growth (Harbert, 1982), and many landowners contacted by SWEPCO/CLECO in the mine area prefer to have their land restored to forest (Camp, 1982).

Postmining land use will consist primarily of managed and unmanaged forest with restoration of some pastureland, fish and wildlife habitat, and water resources.

1.4 ENVIRONMENTAL EFFECTS OF NO ACTION

If the proposed mine is not constructed, environmental conditions would remain approximately as they presently exist. However, economic development is presently occurring in the project region and is expected to continue.

1.5 ENVIRONMENTAL EFFECTS OF THE PROPOSED PROJECT

Environmental consequences of the proposed project and overburden handling alternatives for the project are presented in tabular form (Table 1-1). A brief summary of effects follows.

1.5.1 Topography

Construction activities, involving the surface or near-surface disturbance by grading of approximately 253 hectares (625 acres) of land for mine facilities, dragline erection pads, haul and access roads, stream diversions (outside mining blocks), and the lignite conveyor system for life-of-mine will result in direct short-term adverse impacts on topography.

Direct short-term adverse impacts to the topography of the area will also result from mining. A 5- to 10-percent net volume increase is expected to occur in the replaced overburden after removal of the lignite. Reclamation activities will include reshaping the mined surface to a configuration similar to premining topography; this activity will take place immediately after each separate mining operation. Therefore, adverse impacts resulting from mining operations will be minor after reclamation.

TABLE 1-1

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED DOLET HILLS LIGNITE MINE PROJECT

Factor	Project Alternatives	No-Action Alternative
Topography and Geology Resources	Direct short-term adverse impacts from grading of approximately 625 acres for ancillary use. Direct short-term adverse impacts to topography from mining. Localized long-term adverse impacts to shallow surface sediments. Short-term disturbance of oil and gas wells. Irretrievable committment of gravel resources within permit area.	No adverse impacts to topography or geologic structure; loss of recovery of lignite resources.
Soils	(1) DHMV's Preferred Alternative - Selective Handling of Overburden Short-term adverse impacts from accelerated erosion lessened by seeding, mulching, revegetation. Loss of 7,431 acres of SCS designated prime farmland; 68 acres of LOCSMD prime farmland. Short-term reversible impacts in surface layers due to low organic matter and microbial content. Potential long-term adverse impact on productivity ratings, if future use is crop or pastureland. No effect on forest use, which constitutes principal postmining land use. (2) Topsoil Segregation over Random Overburden Mix Alternative Accelerated erosion, loss of prime farmland. (3) Random Overburden Mix Alternative Short-term reversible adverse impacts from surface crusting and low microbial and organic matter content. Short-term reversible adverse impacts from localized acidic hot spots correctible by liming, reburying, topsoiling. Loss of prime farmland.	Continued erosion from timber removal and agriculture.

TABLE I-1 (Continued)

Factor	Project Alternatives	No-Action Alternative
Ground Water	(1) Preferred Alternative - Selective Handling of Overburden Adverse impacts to transmissivity of aquifer, however, average yield once overburden is recharged should be similar to premining conditions. Adverse impact from destruction of approximately 48 wells, however, the wells can be redrilled after mining. Wells not destroyed will be subject to short-term effects of drawdown from dewatering/depressurization. Long-term adverse impact to ground-water quality from chloride and sulfate limited to mined area and near vicinity. (2) Topsoil Segreation over Randon Overburden Mix Alternative Same as (1) above. (3) Randon Overburden Mix Alternative Same as (1) above.	Potential future lignite mining in the project region could adversely impact ground water resources.
Surface Water	(1) Preferred Alternative - Selective Handling of Overburden Short-term impacts on surface water hydrologic regime i.e., temporary reductions of stream flow in decreased runoff, increased overland flow, increased sediment load. Short-term adverse water quality impacts. (2) Topsoil Segregation over Random Overburden Mix Alternative Same as (1); sediment load will differ. (3) Total Overburden Mix Alternative Same as (1) plus potential short-term reversible impacts from localized acidic hotspots that can be mitigated.	No adverse impacts.
Air Quality	Short-term adverse impacts through emission of particulate matter which are expected to be periodic, local in nature, and minor due to dispersion characteristics in the region.	Potential adverse impacts from future industrial development.

TABLE I-1 (Continued)

Factor	Project Alternatives	No-Action Alternative
Sound	Short-term adverse impacts to local noise-sensitive receptors (four churches and Mansfield Battle Park) when operations are nearby.	Little or no change in areas baseline ambient sound level.
Vegetation	Preemption of 253 hectares (625 acres) of vegetation for life of mine in ancillary area. Long-term direct adverse impacts to 15,466 acres of primarily upland forest, grassland, and revegetation/cutover areas by vegetation removal incrementally of the 32-year life of mine during mining operations. Downstream and adjacent biotic communities will be adversely affected by alteration of physical and chemical variables associated with clearing activities.	Potential adverse impacts from current trends of converting upland and bottomland forest and shrub communities to managed pine forest/plantation or pastureland or row cropland.
Wetlands	Approximately 4.6-6.1 hectares (15-20 acres) of the 102.3 hectares (253 acres) delineated as wetlands by the USCE will be directly and adversely impacted by mining operations. The remaining wetlands may be indirectly and adversely affected by project activities.	Potential adverse effects from future timber operations.
Wildlife	Long-term adverse effects from habitat removal. Induced short-term adverse impacts on wildlife populations adjacent to construction and mining activities. Mitigation includes creation of fish and wildlife habitat and development of water resources representing approximately two percent of the postmining land use in the permit area.	Potential adverse effects from gravel mining and timber operations.
Aquatic Ecology	Adverse impacts to stream through channel realignment, increase in suspended solids, changes in nutrient input, reduction in shade and organic material provided by riparian vegetation, and alteration of flow regime. Solids loading and substrate blanketing will be mitigated by sediment control structures.	Silviculture and oil and gas production are expected to continue, resulting in the present level and nature of impacts to the aquatic environment to continue.
Threatened or Endangered Species	No effect on Red-cockaded Woodpecker.	Project(s) without Federal actions may affect species.
Cultural Resources	Direct adverse impacts to three historic sites. Cultural resources impacts will be mitigated through an MOA.	Potential adverse effects from weathering and vandalism. Knowledge gained through investigation of sites to be impacted would be lost.

TABLE 1-1 (Concluded)

Factor	Project Alternatives	No-Action Alternative
Population	Both short- and long-term impacts to the local population. Additional increases in secondary work force.	Potential long-term increases to the population caused by future development.
Economy	Both short- and long-term beneficial impacts will result directly from the project (wages, land purchases and capital expenditures). Indirect beneficial impacts will result from employment of secondary workers.	Potential short- and long-term changes possible with future development.
Housing	Short-term adverse impact through increased demand on the area's tight housing market. Long-term beneficial impacts to housing construction and mobile home sales will probably occur.	Potential short-term adverse impacts if future development occurs.
Community Services	Short and potential long-term adverse impacts on already deficient utility systems in all project area towns. Most municipal utility systems may require capital improvements. Increased demand on local community services (police, fire, health care, and schools) may require them to operate above prescribed capabilities. However, tax bases in most local jurisdictions should eventually increase to meet demands.	Possible short- and long-term adverse impacts due to potential future industrializations. Deficient utility systems will require capital improvements with or without the project.
Community Finances	Some possible short-term dislocation due to increased service demands prior to project-related increases in tax revenues. Long-term beneficial impacts to municipal, county, and state finances associated with tax revenues.	Short- and long-term adverse impacts related to the loss of revenue from the proposed project.
Transportation	Adverse impacts on already congested local roads and highways through increased vehicle trips, most notably on U.S. 171, U.S. 84, LA 1, LA 175. Planned construction of I-49, a north south four-lane expressway connecting I-10 and I-20 will help mitigate congestion. Short-term (less than one day) interruption on LA 175 will occur twice in the project to move a dragline.	Potential short- and long-term effects from possible future industrial development.
Land Use	Direct adverse impacts for the life of mine primarily result from conversion of 253 hectares (625 acres) of primarily developed and undeveloped forestland to industrial use. The remaining approximately 6,259 hectares (15,466 acres) will be directly affected by mining but will be reclaimed. An estimated 140 dwelling, one church and one cemetery are within proposed mining blocks. The cemetery will be avoided. Relocation and temporary disruption of two state highways will occur.	Potential long- and short-term adverse impacts from industrial/commercial growth increasing the conversion and loss of agricultural land including undeveloped forest and pastureland. Increased urbanization.

1.5.2 Geological Resources

Construction activities associated with the mine ancillary area will result in localized long-term displacement of shallow surface sediments; no adverse impacts to geologic resources will occur.

The geologic units of the mine area that overlie the recoverable lignite will experience unavoidable long-term alterations. Disturbance of oil and gas wells in the mined area will be short-term as production can resume once mining activities are completed. Further, iron-ore gravel is currently being mined within the permit area, and any additional gravel resources within the mine boundaries will be irretrievably lost.

1.5.3 Soils

Land clearing prior to construction of mine facilities will create short-term adverse impacts associated with accelerated erosion, particularly on soils with steep slopes. The severity of erosion will be lessened by employing erosion control methods such as seeding, mulching, etc. until exposed areas are revegetated. Soil erosion resulting from mine operations will be short-term because the area will be stabilized following revegetation.

Initially, existing soils would be replaced with selected sandy layers of unoxidized overburden material, or where absent, selected layers from the oxidized zone. The use of unoxidized overburden would create short-term, adverse impacts in surface layers due to low organic matter and microbial content. Production for cultivated crops and pasture may be somewhat limited while pine forests would have good potential. Under worst case conditions, the use of unoxidized overburden as surface material could locally create soils that have a high acid-bearing potential. Such conditions could be detrimental to plant growth. Should such conditions occur, however, Louisiana Office of Conservation Surface Mining Division (LOCSMD) regulations require burying or otherwise treating acid-forming and toxic-forming overburden within 30 days of exposure.

Approximately 3,013 hectares (7,444 acres) within the permit area are designated as prime farmland under Soil Conservation Service (SCS) criteria, and about 27.5 hectares (68 acres) have a land-use history that qualifies it as prime farmland under Louisiana Surface Mining Regulations. Prime farmland will be directly and adversely impacted within the mined area and ancillary construction area, and may be adversely affected in the remaining ancillary area. The cumulative effects of lignite development in the region (i.e., seven power plants and/or mines) represents a major adverse impact on prime farmlands.

1.5.4 Water Resources

Surface-water quality and quantity during construction will incur some short-term adverse impacts on or adjacent to the permit area. Construction will adversely impact existing drainage patterns, overland runoff volumes, peak runoff rates, and sediment loadings. Temporary reductions of streamflow will result in some localized areas (e.g. , below stream diversions), while runoff will increase at other locations such as temporarily denuded areas and streams receiving diverted runoff from other areas. The stream reroutes planned will generally consist of diversions into parallel channels to allow the recovery of lignite in the original channel locations. Approximately 15.9 kilometers (9.9 miles) of temporary and 10.8 kilometers (6.7 miles) of permanent stream diversions will be constructed parallel to existing streams in the permit area over the life of the mine. During construction, the adverse impact of increased runoff and sediment loadings to existing streams will occur. After construction, flow will be diverted to the new stream and the original streambed will be mined. For temporary diversions, the impact to the original stream will be short-term as the stream will be replaced following mining. Streams diverted into permanent structures will not be replaced, thus resulting in a long-term adverse impact. As these diversions will be very localized, with the exception of Tenmile Bayou to be diverted into the Red River Basin for approximately two years, long-term effects on downstream flows are not anticipated. Measures such as riprap, energy dissipators, etc. will be employed as necessary to minimize adverse impacts. Increases in sediment production resulting from construction activities will cause periodic short-term adverse impacts on water quality. Sediment control measures such as mulches, straw dikes, vegetative filters, and detention basins will be implemented as necessary to minimize sediment production during the construction phase.

During mining operations surface-water hydrologic and water quality characteristics of the site will be subject to continual change as the activities progress. Runoff volumes from the mine site will be temporarily increased as the land is prepared for mining, but contributions to peak discharges downstream of these areas will actually be decreased as a result of the impoundment of runoff in sedimentation ponds. Diversions of overland flow and stream diversions to facilitate mining in specific areas will result in some unavoidable, temporary, but minor localized changes in the runoff of affected watersheds. Adverse impacts of mining on the low flow and flow-duration characteristics of area streams should be minor, as most of the local streams are classified as intermittent and thus exhibit no significant baseflow. As mined areas are reclaimed, hydrologic characteristics will gradually approach premining conditions. Parameters of mine runoff waters that are limited in EPA's NPDES permit for the sedimentation ponds (i.e., total suspended solids, total iron, manganese, and pH), can potentially cause minor impacts on the surface water quality of receiving streams. Constituents in mine runoff waters which are not covered by the New Source Performance Standards (NSPS) (e.g., heavy metals) are not expected to result in water quality problems. Available overburden geochemistry data do not indicate concentrations of toxic substances which would result in major adverse runoff water-quality impacts. Additionally, if such constituents are present in runoff waters, excessive concentrations in discharged effluents will be prevented, in most instances, by pH and total suspended solids control in the sedimentation ponds. Compliance with the applicable permit monitoring and reporting requirements for Louisiana Department of Natural Resources (LDNR) will provide the means for identifying excessive toxic constituent levels in the effluents, at which time appropriate mitigative action will be taken, if necessary. Wastewater sources associated with the mine, such as domestic sewage and vehicle washwater, will cause only minor adverse water-quality impacts as they will comply with applicable water-quality standards.

Construction of ancillary facilities will not cause adverse impacts to either ground-water quality or quantity of the region. Mining operations will remove approximately 48 water wells, all of which were drilled for domestic use. The maximum distance of worst-case adverse impact to the water table elevation by mining will be approximately one-half mile from mining operations. Thus, other wells in the area within the half-mile radius will be subject to a relatively short-term decrease in productivity due to a water-level drawdown. Adverse impacts to the productivity of ground-water wells lying outside one-half mile of the mined area will be minimal. When the area is reclaimed and the material is resaturated, wells completed into the reclaimed area should be able to produce yields comparable to the existing normal rate of use in the area, but chloride and sulfate will adversely affect the ground-water quality. An analysis of overburden was conducted to examine the acid-forming potential of the material. Only a few zones were identified as having amounts of pyrite capable of causing undesirable acidity. High acidity can create toxic conditions by mobilizing such heavy metal ions as arsenic, manganese, selenium, cadmium, chromium, copper, lead, mercury, nickel, zinc, and vanadium. However, alkalinity exists in most cases at levels sufficient to neutralize any acid which may develop. In addition, heavy metal concentrations are sufficiently low, as indicated by ground-water analysis and results of chemical analysis of overburden samples. It is anticipated that ground-water degradation resulting from the operation of the mine will be limited to the mined area and near vicinity. If any users of surface and/or ground water are subjected to contaminated, diminished, or interrupted supplies as a result of the mining activites, DHMV will replace the affected supplies with suitable alternative sources in accordance with LOCSMD regulations.

1.5.5 Air Quality

Construction and operations will cause particulate matter to be emitted into the atmosphere. Emission from these activities will be intermittent and spread out over a large area, and most particle settling will occur next to the source. Adverse impacts on air quality will be periodic, local in nature, and minor.

1.5.6 Radioactive Emissions

Radon-222 (Rn-222) will be released into the atmosphere as a result of mining operations. The release of Rn-222 during mining operations would not be expected to be greatly different from average soils. Following reclamation, the Rn-222 emanation rate will be less than the predisturbed rate at some locations, while at other locations in the reclaimed mine area, it will be greater.

1.5.7 Sound Quality

Increased noise levels associated with construction and operations will have periodic short-term adverse impacts on local noise-sensitive receptors (four churches and Mansfield Battle Park). At mining operations near the Mansfield Battle Park, a $L_{(dn)}$ of 69 dBA is expected, which is an increase of 15 dBA over ambient levels.

1.5.8 Ecology

1.5.8.1 Vegetation

Site preparation and construction within the permit area will remove approximately 253 hectares (625 acres) of vegetation for the life-of-mine in those portions of the ancillary area where offices, workshops, dragline erection pads, haul and access roads, stream diversions (outside mining blocks), etc., will be built. Approximately 102.3 hectares (253 acres) of USCE delineated regulatory wetlands occur in the permit area. Approximately 6 hectares (15 acres) will be directly and adversely impacted around the year 1987; the rest may be indirectly and adversely impacted. In order to minimize adverse impacts associated with soil erosion and sediment-loading to plant communities either downstream or adjacent to construction activities, control structures such as sedimentation ponds and hay bales will be located as close as possible to potential sediment sources. Site preparation and construction will produce unavoidable short-term adverse impacts to vegetation left standing adjacent to cleared areas. Primary production in vegetation may be reduced due to dust accumulation on foliage adjacent to construction areas.

During the 32-year life-of-mine, approximately 6,186 hectares (15,466 acres) of primarily upland forest, grassland, and regeneration/cutover areas will be cleared prior to actual mining. Approximately 317 hectares (783 acres) of that total is bottomland forest. Premining clearing will proceed incrementally and will be followed immediately by postmining reclamation. Unreclaimed, disturbed land will average 363 hectares (909 acres) with a maximum of 486 hectares (1,200 acres) of unreclaimed, disturbed land occurring from the year 2000 to 2008. In addition to the direct adverse impacts of vegetation removal, downstream and adjacent biotic communities will be adversely affected by the alteration of physical and chemical variables during operation activities, as well as those impacts associated with construction activities. Lowering of water table elevations will adversely affect wetlands, hillside bogs, and riparian communities in adjacent floodplains that are hydrologically dependent on proposed mine areas. Sensitive areas such as hillside seepage bogs will be lost due to their low probability of being reestablished.

Postmining habitats within the 11,968-hectare (29,573-acre) permit area will consist of approximately 88 percent of managed and unmanaged forest (10,523 hectares;

26,023 acres), 10 percent of improved pasture (1,192 hectares; 2,946 acres), 1.8 percent of wildlife habitat (214 hectares; 530 acres), and approximately 0.2 percent of developed water resources including permanent sedimentation ponds and livestock and wildlife watering ponds (30 hectares; 74 acres). Areas within the mined area that are restored to forest will be primarily commercial pine.

1.5.8.2 Wildlife

The primary overall adverse impact of construction and operations activities will be the clearing of wildlife habitat, thereby resulting in the direct destruction of some forms of wildlife that are not mobile enough to avoid clearing activities. Larger, more mobile species of wildlife may immigrate into adjacent habitats and compete with resident individuals, eventually resulting in decreased productivity and/or increased mortality such that populations will be reduced to that which the habitat can support. Loss of wildlife habitat due to stream diversions (outside of mining blocks) will be 3.7 hectares (9.2 acres) of bottomland hardwood forest, 2.5 hectares (6.1 acres of grasslands) 2.3 hectares (5.9 acres) of regeneration cutover areas, and 2.7 hectares (6.6 acres) of upland pine forest. A total of approximately 317 hectares (783 acres) of bottomland forests will be pre-empted, resulting in the long-term adverse loss of diverse wildlife communities.

Reclamation efforts will reduce adverse impacts to wildlife to some extent; however, habitats such as mature pine-beech forest, the limited swamps, and bottomland hardwoods will not be replaced. Overall diversity throughout the mined areas will be reduced. The structure and species composition of wildlife communities in the affected areas will be greatly changed. This will result in a major adverse long-term impact on the wildlife resources of the area. The cumulative effects of lignite development in the region constitute an irretrievable commitment of the more sensitive wildlife habitat types (e.g., marshes, swamps, bogs, etc.) that cannot or may not be fully re-established after reclamation.

In July 1982, EPA requested that the U.S. Fish and Wildlife Service (FWS) provide a list of threatened and endangered species that might occur within the project vicinity. The FWS responded that the Red-cockaded Woodpecker may occur in the area and that a Biological Assessment was required. A biological assessment has been prepared by EPA to consider the possible effects of the proposed surface lignite mine on the Red-cockaded Woodpecker. As a result of this assessment, EPA determined that there is "no effect" on the

Red-cockaded Woodpecker. This determination has been provided to the FWS (Jackson, Mississippi) for review.

1.5.8.3 Aquatic Ecology

Construction and mining activities will adversely impact streams of the project site through: 1) destruction of existing stream channels (e.g., channel realignment); 2) increases in suspended solids loading; 3) changes in nutrient inputs; 4) reduction in the shade and organic material provided by riparian vegetation; and 5) alteration of the flow regime. Outside the permit boundaries, categories 2), 3), and 5) could be expected to produce adverse impacts on the downstream segments of these water courses.

Stream diversions will be constructed on Chatman and Tenmile bayous in the Sabine River drainage and on West Branch, Dolet, Louies, and Prairie bayous in the eastern mining area in the Red River drainage. Chatman, Tenmile, Louies, and Prairie bayous will be permanent diversions. These existing aquatic habitats (10,744 meters; 35,250 feet) will be lost, constituting a long-term adverse impact. Populations of aquatic plants and animals should develop over the long-term in the new permanent diversions and mitigate some of the losses.

1.5.9 Cultural Resources

Eighteen percent (approximately 2,154 hectares or 5,323 acres) of the permit area has been surveyed and a total of 59 cultural resources within the mine permit boundaries have been recorded. This includes 13 archeological sites, 10 standing structures, 27 possible archeological sites, 7 isolated occurrences, and 2 historic cemeteries. Mansfield Battle Park, located adjacent to and west of the permit boundary, is currently listed on the National Register of Historic Places (NRHP). No known cultural resource sites within the surveyed portion are listed on the NRHP. One historic standing structure is considered eligible for nomination to the NRHP by the surveying archaeologists and has been recommended for further work. Four additional sites are recommended for further work to determine their potential eligibility for nomination to the NRHP.

Operations will not come closer than 91 meters (300 feet) to Mansfield Battle Park. Of the sites recommended for further evaluation, two are within the ancillary activities area but should not be directly impacted by construction activities. In addition, surveys of the remaining permit area may reveal additional cultural resources within the impact area that may be eligible for nomination to the NRHP. A draft Proposal of Agreement is being coordinated among EPA, the Louisiana State Historical Preservation Officer, and the Advisory Council on Historic Preservation to be utilized in preparing a Memorandum of Agreement (MOA). Compliance with the MOA as a condition of the NPDES permit should satisfy the requirements of Section 106 and adequately protect cultural resources. Cumulatively, an overall beneficial impact may be derived from the expansion of knowledge regarding past cultures gained through surveys provided with Section 106 compliance on other Federal projects in the region.

1.5.10 Socioeconomics

Only about 22 of the peak 112 construction workers during 1984-1985 are anticipated to be hired from the local labor force. Based upon similar energy-related worker profiles and existing characteristics of the project area, approximately 45 will in-migrate to communities in the area, and another 45 will commute from Shreveport. The 67 locally residing construction workers could provide approximately 54 secondary jobs; increased population associated with in-migrating primary and secondary workers and their families will be 114 and 124, respectively. The project area average vacancy rate for owner-occupied housing is extremely low. Mobile homes are likely to be the predominant form of housing for in-migrating construction workers. Expansion of housing is constrained by deficiencies in utility infrastructure in all area towns. Most project-area municipal utility systems may require capital improvements if project-related housing, water, and sewage needs are to be met. The total of 238 in-migrants related to project construction may cause some local community services such as police and fire protection, health facilities, and schools to operate above their prescribed capacities, resulting in adverse impacts. Construction of the proposed mine project will create adverse increases over existing traffic levels along U.S. 84 and 171 and LA1 and 175. Some roads in the area are approaching or have exceeded design capacity.

Projected labor expenditures over the 3.5-year construction period are estimated at $4.9 million, with $2.45 million occurring in the peak construction years. Secondary income could account for an additional $3.75 million in the project area. Project expenditures for equipment, materials, and other nonlabor requirements will be an estimated $63.2 million. Of the $51.1 million to be spent on machinery, materials, power, and fuels, it is estimated that about seven percent, or $3.46 million, will be spent locally. Local secondary income from nonlabor expenditures could amount to about $8.7 million.

During Phase I of the full operations phase (1986-1992) of the proposed project, a maximum of 213 workers will be employed, of which 90 percent will be in-migrants. Phase II of operations (1993-2017) will increase the operations work force to 400 employees. This peak level operations work force of 400 would support about 600 secondary jobs. However, a number of construction-induced workers will probably remain in the area after termination of the construction phase, and thus could fill both operations-induced primary and secondary jobs locally.

At full operation of the mine, operations employees and their families would add about 1,199 persons to the surrounding parish area population. It is projected that approximately 70 percent of in-migrating workers will seek single family housing. Adverse impacts resulting from the increased population could include: a demand for adequate housing upon already low housing stocks in the early years of operation; the need to improve water and wastewater systems; and the need to expand community services.

Average annual direct operations expenditures are estimated at $23.28 million per year between 1986-1992, and $56.9 million per year between 1993-2017 (1981 dollars). Salaries paid to local employees will amount to about 27 percent of total annual costs. Local secondary income to the area resulting from operations workers consumer expenditures is estimated to amount to an annual average of about $7.6 million and $14.1 million for Phases I and II, respectively. Approximately seven percent of machinery, materials, power, and fuels expenditures will be spent within the project area for a total of about $658,000 per year during Phase I and $1,750,000 per year during Phase II operations. In addition, between $1.33 and $3.54 million in annual local secondary income effects will result from non-labor operations expenditures. During the operations phase of the project, up to $148,000 per annum in property taxes (based on 1981 tax rates and assuming 100 percent valuation) will accrue to local taxing jurisdictions, principally the county and school district. Ad valorem taxes would also accrue to local governments as a result of worker ownership of residential property. Sales taxes would generate additional revenue for area municipalities.

Operations will increase vehicular traffic on already congested roads, and the relocation of LA 522 may cause temporary disruption of traffic on that roadway.

Adverse visual impacts will be experienced by some travellers on LA 175 and 522 when operations commence in those areas. These impacts will be short-term as land will be reclaimed after mining.

1.5.11 Land Use

The lignite project will convert approximately 253 hectares (625 acres) of primarily developed and undeveloped forestland to industrial use. Indirect land-use impacts include changes resulting from residential construction and associated utilities installation for construction-related in-migrants. Approximately 6,259 hectares (15,466 acres) will be directly affected by mining, including 2,883.5 hectares (7,125 acres) of undeveloped forest, 2,655 hectares (6,561 acres) of developed forest, 601 hectares (1,484 acres) of pastureland, 79 hectares (195 acres) of cropland; 32 hectares (79 acres) of grazing land, 4 hectares (9 acres) of water, 2.5 hectares (6.2 acres) of residential land, and 2.5 hectares (6.2 acres) of commercial-industrial land. An estimated 140 dwellings, one church, and one cemetery are located within the proposed mining blocks. All cemeteries within the permit area will be avoided and no mining activities will approach within 30.4 meters (100 feet) of a cemetery; access will be maintained. Mining in the northwest portion of the site will require the partial relocation of LA 522. A conveyor system will cross LA 175 until the southwestern section of the permit area has been mined. In addition, a temporary disruption of highway traffic will occur twice during mining operations to move two draglines. Discussions regarding schedules and procedures are currently underway with the Louisiana Department of Transportation and Development.

The five pipelines found in the permit area will be relocated prior to mining. Schedules and procedures for all relocations will be agreed upon with pipeline operators. Production activities at the estimated 60 oil and gas wells located inside the permit area will be discontinued during mining activities and resumed following reclamation, at the well operator's direction. Water lines associated with the East De Soto Water System in the southeast portion of the site near LA 346 will be relocated as necessary.

The effect of removing approximately 2,655 hectares (6,560 acres) of forestland from production in the proposed mining blocks can be assessed by estimating production and value of standing pine on the site. Potential production for De Soto Parish is estimated at two cords per acre per year of pine pulpwood, or 500 to 1,000 board feet per year of pine sawtimber. Values (1981 dollars) are estimated to be $12 to $18 per cord or $200 to $280 per 1,000 board feet. Therefore, a loss of $157,440 to $1,836,800 per year is possible due to the proposed project. The lesser figure assumes utilization of forested areas for pulpwood, while the higher figure assumes utilization for sawtimber. At the present time, approximately 70 percent of the commercial forestland within the permit area is suitable for pulpwood production, and 30 percent is mature enough for sawtimber.

2.0 TABLE OF CONTENTS

PAGE

Abstract ii
1.0 SUMMARY 1-1
1.1 BACKGROUND 1-1
1.2 ALTERNATIVES 1-1
1.3 PROPOSED PROJECT 1-2
1.4 ENVIRONMENTAL EFFECTS OF NO ACTION 1-4
1.5 ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION 1-4
1.5.1 Topography 1-4
1.5.2 Geological Resources 1-9
1.5.3 Soils 1-9
1.5.4 Water Resources 1-10
1.5.5 Air Quality 1-12
1.5.6 Radioactive Emissions 1-12
1.5.7 Sound Quality 1-12
1.5.8 Ecology 1-13
1.5.8.1 Vegetation 1-13
1.5.8.2 Wildlife 1-14
1.5.8.3 Aquatic Ecology 1-15
1.5.9 Cultural Resources 1-15
1.5.10 Socioeconomics 1-16
1.5.11 Land Use 1-18
2.0 TABLE OF CONTENTS 2-1
3.0 INTRODUCTION, PURPOSE AND NEED 3-1
3.1 EPA'S RESPONSIBILITY AND LEGISLATIVE AUTHORITY 3-1
3.2 OTHER FEDERAL, STATE, AND LOCAL LEGISLATIVE REQUIREMENTS 3-1
3.3 DESCRIPTION OF THE APPLICANT 3-2
3.4 PURPOSE AND NEED FOR THE PROPOSED PROJECT 3-2
4.0 DESCRIPTION AND EVALUATION OF ALTERNATIVES 4-1
4.1 NO ACTION ALTERNATIVE OF THE APPLICANT 4-1
4.2 ALTERNATIVE ENERGY SOURCES FOR THE DOLET HILLS POWER PLANT 4-1
4.3 DESIGN AND SITING OPTIONS FOR THE CONSTRUCTION AND OPERATION OF THE PROPOSED MINE 4-2
4.3.1 Mine Layout Alternatives 4-2
4.3.1.1 Total Mining of the Dolet Hills Deposit 4-2
4.3.1.2 Partial Mining of the Dolet Hills Deposit 4-2

TABLE OF CONTENTS (Cont'd) PAGE

4.3.2 Mine Operation Alternatives 4-3
4.3.2.1 Underground Mining 4-3
4.3.2.2 Auger Mining 4-3
4.3.2.3 Surface Mining 4-4
4.3.3 Overburden Removal Alternatives 4-4
4.3.3.1 Draglines 4-4
4.3.3.2 Motorized Scrapers 4-4
4.3.3.3 Bucket-wheel Excavators 4-5
4.3.3.4 Combination 4-5
4.3.4 Lignite Extraction Alternatives 4-5
4.3.4.1 Power Shovel 4-6
4.3.4.2 Front-End Loader 4-6
4.3.4.3 Hydraulic Backhoe 4-6
4.3.4.4 Continuous Miner 4-6
4.3.4.5 Combination 4-7
4.3.5 Lignite Transportation Alternatives 4-7
4.3.5.1 Trains 4-7
4.3.5.2 Haul Trucks 4-7
4.3.5.3 Conveyors 4-7
4.3.5.4 Combination 4-8
4.3.6 Reclamation Alternatives 4-8
4.3.6.1 No Selective Placement 4-8
4.3.6.2 Topsoil Segregation and Replacement 4-9
4.3.6.3 Selective Placement of Materials 4-9
4.3.7 Sanitary Waste Disposal Systems Alternatives 4-10
4.3.7.1 Existing Sewage Treatment Plant 4-10
4.3.7.2 Septic Tank 4-10
4.3.7.3 Packaged Plant 4-10
4.4 DESCRIPTION OF APPLICANT'S PREFERRED ALTERNATIVE 4-11
4.4.1 Ancillary Facilities 4-15
4.4.1.1 Main Office Block 4-15
4.4.1.2 Field Workshop Facilities 4-15
4.4.1.3 Erection Sites 4-20
4.4.1.4 Lignite Haul Roads 4-20

TABLE OF CONTENTS (Cont'd) PAGE

4.4.1.5 Conveyor System 4-21
4.4.1.6 Electric Transmission Lines 4-21
4.4.1.7 Waste Treatment 4-21
4.4.2 Mineable Reserves 4-21
4.4.3 Mining Sequence 4-22
4.4.4 Mining Equipment and Methods 4-25
4.4.4.1 Major Mining Equipment 4-25
4.4.4.2 Land Clearing 4-25
4.4.4.3 Overburden Removal 4-25
4.4.4.4 Lignite Loading and Hauling 4-28
4.4.4.5 Spoil Grading 4-29
4.4.4.6 Drainage and Erosion Control 4-29
4.4.4.7 Dewatering 4-40
4.4.4.8 Road Construction and Maintenance 4-41
4.4.5 Reclamation and Revegetation 4-44
4.4.5.1 General Reclamation Procedure 4-44
4.4.5.2 Revegetation 4-47
4.5 ALTERNATIVES AVAILABLE TO EPA 4-47
4.6 ALTERNATIVES AVAILABLE TO OTHER PERMITTING AGENCIES 4-51
4.6.1 U.S. Army Corps of Engineers 4-51
4.6.2 Louisiana Office of Conservation, Surface Mining Division 4-51
4.7 OTHER REASONABLE ALTERNATIVES 4-51
5.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES 5-1
5.1 EARTH RESOURCES 5-1
5.1.1 Topography 5-1
5.1.1.1 Existing Environment 5-1
5.1.1.2 Effects of No Action 5-1
5.1.1.3 Construction Impacts 5-1
5.1.1.4 Operation Impacts 5-2
5.1.1.5 Combined Impacts of Power Plant and Mine 5-3
5.1.2 Geology 5-3
5.1.2.1 Existing Environment 5-3
5.1.2.2 Effects of No Action 5-5
5.1.2.3 Construction Impacts 5-5

TABLE OF CONTENTS (Cont'd) PAGE

5.1.2.4 Operation Impacts 5-6
5.1.2.5 Combined Impacts of Power Plant and Mine 5-6
5.1.3 Soils 5-7
5.1.3.1 Existing Environment 5-7
5.1.3.2 Effects of No Action 5-18
5.1.3.3 Construction Impacts 5-18
5.1.3.4 Operation Impacts 5-19
5.1.3.5 Combined Impacts of Power Plant and Mine 5-22
5.2 WATER RESOURCES 5-23
5.2.1 Ground Water 5-23
5.2.1.1 Existing Environment 5-23
5.2.1.2 Effects of No Action 5-28
5.2.1.3 Construction Impacts 5-28
5.2.1.4 Operation Impacts 5-28
5.2.1.5 Combined Impacts of Power Plant and Mine 5-37
5.2.2 Surface Water 5-38
5.2.2.1 Existing Environment 5-38
5.2.2.2 Effects of No Action 5-48
5.2.2.3 Construction Impacts 5-48
5.2.2.4 Operation Impacts 5-50
5.2.2.5 Combined Impacts of Power Plant and Mine 5-55
5.3 CLIMATOLOGY/AIR QUALITY 5-56
5.3.1 Existing Environment 5-56
5.3.1.1 Climatology 5-57
5.3.1.2 Existing Air Quality 5-59
5.3.2 Effects of No Action 5-60
5.3.3 Construction Impacts 5-60
5.3.4 Operations Impacts 5-61
5.3.4.1 Impact of Process Emissions 5-61
5.3.4.2 Impact of Fugitive Emissions 5-61
5.3.4.3 Impact of Radioactive Emissions 5-62
5.3.5 Combined Impacts of Power Plant and Mine 5-63
5.3.5.1 Combined Impacts of Radioactive Emissions from the Power Plant and Mine 5-63

TABLE OF CONTENTS (Cont'd) PAGE

5.4 SOUND QUALITY 5-63
5.4.1 Existing Environment 5-67
5.4.2 Effects of No Action 5-68
5.4.3 Construction Impacts 5-68
5.4.4 Operation Impacts 5-69
5.4.5 Combined Impacts of Power Plant and Mine 5-72
5.5 ECOLOGY 5-72
5.5.1 Vegetation 5-73
5.5.1.1 Existing Environment 5-73
5.5.1.2 Effects of No Action 5-82
5.5.1.3 Construction Impacts 5-82
5.5.1.4 Operations Impacts 5-84
5.5.1.5 Combined Impacts of Power Plant and Mine 5-88
5.5.2 Wildlife 5-89
5.5.2.1 Existing Environment 5-89
5.5.2.2 Effects of No Action 5-93
5.5.2.3 Construction Impacts 5-93
5.5.2.4 Operation Impacts 5-95
5.5.2.5 Combined Impacts of Power Plant and Mine 5-97
5.5.3 Aquatic Ecology 5-98
5.5.3.1 Existing Environment 5-98
5.5.3.2 Effects of No Action 5-102
5.5.3.3 Construction Impacts 5-102
5.5.3.4 Operation Impacts 5-103
5.5.3.5 Combined Impacts of Power Plant and Mine 5-106
5.6 CULTURAL RESOURCES 5-106
5.6.1 Prehistoric Overview 5-106
5.6.2 Historic Overview 5-107
5.6.3 Cultural Resources Within the Permit Area 5-107
5.6.4 Effects of No Action 5-109
5.6.5 Construction Impacts 5-109
5.6.6 Operations Impacts 5-110
5.6.7 Combined Impacts of Power Plant and Mine 5-110
5.7 SOCIOECONOMICS 5-111

TABLE OF CONTENTS (Cont'd) PAGE

5.7.1 Existing Environment 5-111
5.7.1.1 Economic Profile 5-111
5.7.1.2 Population Profile 5-112
5.7.1.3 Housing 5-112
5.7.1.4 Community Services and Facilities 5-112
5.7.1.5 Local Government Finances 5-113
5.7.1.6 Transportation Facilities 5-114
5.7.1.7 Recreation Facilities and Aesthetics 5-114
5.7.2 No Action Alternative 5-114
5.7.3 Construction Impacts of the Proposed Project 5-115
5.7.3.1 Economic Impacts 5-115
5.7.3.2 Population Effects 5-117
5.7.3.3 Housing 5-121
5.7.3.4 Community Facilities and Services 5-122
5.7.3.5 Transportation 5-123
5.7.3.6 Recreation Facilities and Aesthetics 5-125
5.7.4 Operations Impacts of the Proposed Project 5-125
5.7.4.1 Economic Impacts 5-125
5.7.4.2 Population Effects 5-129
5.7.4.3 Housing 5-129
5.7.4.4 Community Services and Facilities 5-131
5.7.4.5 Government Finances 5-132
5.7.4.6 Transportation 5-132
5.7.4.7 Recreational Facilities and Aesthetics 5-134
5.7.5 Combined Power Plant and Mine Impacts 5-134
5.7.5.1 Labor Force 5-134
5.7.5.2 Population 5-135
5.7.5.3 Housing 5-135
5.7.5.4 Community Services and Facilities 5-139
5.7.5.5 Local Government Finances 5-141
5.7.5.6 Transportation 5-141
5.7.5.7 Recreation 5-142
5.8 LAND USE 5-142
5.8.1 Existing Environment 5-142

TABLE OF CONTENTS (Cont'd) PAGE

5.8.1.1 Land Use of the Permit Area Region 5-142
5.8.1.2 Land Use of the Project Area 5-143
5.8.1.3 Land Use of the Permit Area 5-144
5.8.2 Impacts of No Action Alternatives 5-148
5.8.3 Impacts of Construction 5-148
5.8.4 Impacts of Operation 5-149
5.8.5 Combined Impacts 5-150
5.9 CUMULATIVE IMPACTS 5-151
5.9.1 Soils 5-151
5.9.2 Ground Water 5-154
5.9.3 Surface Water 5-156
5.9.3.1 Hydrologic Conditions 5-156
5.9.3.2 Water Quality 5-157
5.9.4 Air Quality 5-157
5.9.4.1 Acid Rain 5-158
5.9.4.2 Radioactive Emissions 5-158
5.9.5 Ecology 5-158
5.9.6 Socioeconomics 5-159
5.9.6.1 Employment Effect 5-159
5.9.6.2 Community Services and Facilities 5-161
5.9.6.3 Transportation 5-161
5.9.6.4 Recreation 5-161
5.9.7 Land Use 5-162
5.9.8 Cultural Resources 5-163
5.10 EFFECTS OF ALTERNATIVES AVAILABLE TO EPA 5-163
5.10.1 Issuance of Permit 5-164
5.10.2 Denial of Permit 5-164
6.0 COORDINATION (INCLUDING EIS MAILING LIST) 6-1
6.1 SCOPING PROCESS 6-1
6.2 FEDERAL AGENCIES 6-1
6.2.1 U.S. Army Corps of Engineers 6-1
6.2.2 U.S. Fish and Wildlife Service 6-1
6.3 STATE AGENCIES 6-2
6.3.1 Louisiana Office of Conservation, Surface Mining Division 6-2

TABLE OF CONTENTS (Concluded) PAGE

6.3.2 Louisiana Department of Transportation and Development 6-2

6.4 LIST OF AGENCIES, ORGANIZATIONS AND PERSONS TO WHOM COPIES OF THE DRAFT STATEMENT ARE SENT 6-2

7.0 LIST OF PREPARERS 7-1

8.0 BIBLIOGRAPHY 8-1

9.0 GLOSSARY 9-1

LIST OF ABBREVIATIONS LA-1

CONVERSION TABLE CT-1

APPENDIX A - Draft NPDES Permit A-1

APPENDIX B - Permit Area Sedimentation Pond Conceptual Requirements B-1

APPENDIX C - Overburden Lignite Physical/Chemical Analysis Data C-1

APPENDIX D - Draft Memorandum of Agreement (MOA) D-1

INDEX I-1

LIST OF FIGURES PAGE

4-1 Regional Location 4-12
4-2 Mine Facilities Area - Main Office Area 4-16
4-3 Mine Service Facilities - Main Office and Workshop 4-17
4-4 Mine Service Facilities - Field Workshop and Dragline Erection Area 4-18
4-5 Mine Service Facilities - Field Workshop 4-19
4-6a Mining Sequence - West Area 4-23
4-6b Mining Sequence - East Area 4-24
4-7a Sedimentation Ponds - West Area 4-30
4-7b Sedimentation Ponds - East Area 4-31
4-8 Type 1 Sedimentation Pond 4-32
4-9 Type 2 Sedimentation Pond 4-33
4-10 Type 3 Sedimentation Pond 4-34
4-11 Typical Runoff Diversion Structure 4-36
4-12 Typical Temporary Stream Diversion Cross Section 4-38
4-13 Typical Permanent Diversion 4-39
4-14 Typical Haul Road Cross Sections 4-42
4-15 Typical Stream Crossing 4-45
5-1a Soils of the Permit Area - West Area 5-11
5-1b Soils of the Permit Area - East Area 5-12
5-2a Overburden Sampling Locations - West Area 5-15
5-2b Overburden Sampling Locations - East Area 5-16
5-3a Major Watersheds and Water Quality Sampling Stations, Dolet Hills Lignite Project - West Area 5-40
5-3b Major Watersheds and Water Quality Sampling Stations Dolet Hills Lignite Project - East Area 5-41
5-4 Annual Wind Rose, Shreveport, 1970-1974 5-58
5-5a Vegetation of the Permit Area - West Area 5-74
5-5b Vegetation of the Permit Area - East Area 5-75
5-6a Land Use of the Permit Area - West Area 5-145
5-6b Land Use of the Permit Area - East Area 5-146
5-7 Regional Surface Lignite Mines and Power Plants 5-152

LIST OF TABLES PAGE

1-1 Environmental Consequences of the Proposed Dolet Hills Lignite Mine Project 1-5

3-1 Federal and State Permits/Regulations/Approvals Applicable to the Proposed Dolet Hills Lignite Mine Project 3-3

4-1 Estimated Annual Disturbed Areas 4-13

4-2 Schedule of Operation of Major Equipment 4-26

4-3 Major Mining Equipment 4-27

4-4 Representative Vegetation Species to be Used in the Dolet Hills Lignite Mine Reclamation Plan 4-48

5-1 Soil Mapping Units Within Major Soil Groups of the Proposed Dolet Hills Lignite Project 5-8

5-2 Soil Capability Groups and Prime Farmland Within the Dolet Hills Permit Area 5-13

5-3 Groundwater Quality Data From the Naborton and Dolet Hills Formations 5-24

5-4 Projected Radius of Influence of Pit Dewatering 5-32

5-5 Projected Drawdowns at Various Distances from Pit 5-33

5-6 Ranges of Peak Discharge and Runoff Volumes Per Unit Area for Sub-Basins Within the Study Area 5-44

5-7 Parameters Analyzed in Dolet Hills Water Quality Monitoring Program (May 1979-April 1980) 5-45

5-8 Water-Quality Sampling Sites, Dolet Hills Water Quality Monitoring Program (May 1979-April 1980) 5-46

5-9 Mean and Extreme Values for Selected Water-Quality Parameters, Dolet Hills Water-Quality Monitoring Program (May 1979-April 1980) 5-47

5-10 EPA New Source Performance Standards for Coal Mine Discharges 5-53

5-11 Annual Nuclide Emission Rates from Units 1 and 2 5-65

5-12 Estimated Maximum Annual Ground-Level Concentrations, Ambient Background Levels, and Maximum Permissible Concentrations 5-66

5-13 Areal Extent of Vegetational Communities Within the Mine Permit Area of the Proposed Dolet Hills Lignite Project 5-76

5-14 Local Employment Effects Resulting from Project Construction (1982-1986) 5-116

5-15 Estimated Project Construction Expenditures 5-118

5-16 Distribution of Peak Construction-phase Population and Related Community Effects 5-120

LIST OF TABLES (Concluded) PAGE

5-17 Local Employment Effects Resulting from Project Operations (1985-2017) 5-126

5-18 Estimated Operations and Maintenance Expenditures 5-128

5-19 Distribution of Peak Operations-phase Population and Related Community Effects 5-130

5-20 Additional Local Annual Tax Revenue Generated by the Proposed Dolet Hills Mine Project, Operations Phase 5-133

5-21 Combined Power Plant and Mine Construction and Operations Employment Effects 5-136

5-22 Combined Power Plant and Mine Construction and Operations Population Effects 5-137

5-23 Distribution of Peak Combined Power Plant and Mine Population and Related Community Effects (1985) 5-138

5-24 Existing Land Use of the Dolet Hills Mine Project 5-147

5-25 Prime Farmland by Parishes in the Vicinity of the Dolet Hills Lignite Mine Project 5-153

5-26 Prime Farmland Impacted by Present or Planned Surface Lignite Mines/Associated Facilities in the Vicinity of the Dolet Hills Lignite Mine Project 5-155

5-27 Cumulative Employment Effects, Lignite Mine/Power Plant Projects in Northwestern Louisiana (1981-1990) 5-160

3.0 INTRODUCTION, PURPOSE AND NEED

This Supplemental Draft Environmental Impact Statement (Draft SEIS) is prepared as part of the "tiering" concept of EIS's (40 CFR 1502.20), and is intended to supplement the Dolet Hills Power Plant Project Draft EIS (EPA 906/9-81-004) and Final EIS (EPA 906/9-81-005). EPA issued an NPDES permit for the Dolet Hills Power Plant on 25 June 1982.

The Dolet Hills Mining Venture (DHMV), a joint venture partnership (see Sec. 3.3, Description of the Applicant) proposes to construct and operate a surface lignite mine in DeSoto Parish, northwestern Louisiana. The mine will supply lignite to the adjacent Dolet Hills Power Plant, which will generate 1,440 MW of electric power.

3.1 EPA'S RESPONSIBILITY AND LEGISLATIVE AUTHORITY

Before discharge of any pollutant into navigable waters of the United States from a designated source in an industrial category for which performance standards have been promulgated, a new source National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the Environmental Protection Agency (EPA). Section 511 (c) (1) of the Clean Water Act (CWA) also requires that the issuance of an NPDES permit by EPA for a new source discharge be subject to the National Environmental Policy Act (NEPA), which may require preparation of an EIS on the new source. Pursuant to the requirements of NEPA and its authority under the CWA, a notice of intent to prepare a supplemental EIS on the issuance of an NPDES permit for the proposed Dolet Hills Lignite Mine Project was issued by EPA on 1 June 1982.

This Draft SEIS evaluates alternative permit actions (i.e., issuance or denial of permits) available to the EPA and other Federal agencies and the environmental effects of undertaking the most reasonable of these alternatives. This SEIS is intended to be used by EPA to help make decisions based on an understanding of the environmental consequences.

3.2 OTHER FEDERAL, STATE, AND LOCAL LEGISLATIVE REQUIREMENTS

In order for DHMV to construct and operate the proposed surface lignite mine, compliance or conformance with State and Federal laws and regulations is required. These requirements include performance standards, limitations, agency reviews and approvals, and interagency coordination. A list of these required permits and/or regulations and their status is presented in Table 3-1. A brief discussion of certain requirements was included in Appendix A of the Dolet Hills Power Plant Draft EIS (EPA, 1981).

3.3 DESCRIPTION OF THE APPLICANT

The Dolet Hills Mining Venture (DHMV) is a joint venture partnership created under the laws of the State of Texas, with its partners consisting of Costain Holding Inc., a Delaware corporation, Costain Australia Mining Pty. Limited, a Victoria, Australia corporation, and Mansfield Mining Company, a North Carolina corporation with its principal office in Charlotte, North Carolina. DHMV is the construction and operation contractor for the proposed mine owned by Southwestern Electric Power Company (SWEPCO), a Delaware corporation, with its principal office in Shreveport, Louisiana, and Central Louisiana Electric Company, Inc. (CLECO), a Louisiana corporation with its principal office in Pineville, Louisiana.

3.4 PURPOSE AND NEED FOR THE PROPOSED PROJECT

The purpose of the Dolet Hills Lignite Mine Project is to provide fuel to the Dolet Hills Power Plant for the generation of electricity. SWEPCO and CLECO, owners of the power plant, have experienced increasing demand for electricity over the past 15 years, as well as a steady increase in customers.

In addition to SWEPCO's and CLECO's need for additional generating capacity to satisfy future customer demand, additional capacity is needed to provide adequate reserves for reliable service during periods of maintenance and emergency outages. Also, SWEPCO and CLECO wish to diversify their power generation fuel base and lessen dependence on natural gas and oil as sources of boiler fuel.

TABLE 3-1

FEDERAL AND STATE PERMITS/REGULATIONS/APPROVALS APPLICABLE TO THE PROPOSED DOLET HILLS LIGNITE MINE PROJECT

Permit, Regulation or Approval	Agency[a]	Status
NPDES (Section 402) permit under Clean Water Act	EPA	Pending
Water Quality Certification (issued in conjunction with Section 402 and 404 permits)	LDNR	Pending
Wastewater Discharge Permit	LDNR	b
Section 404 permit for placement of dredge and fill material under Clean Water Act	USCE	c
Spill Prevention and Countermeasures Control Plan	EPA	In progress
Solid Waste Disposal Permit	LDNR	b
Compliance with Executive Order 11990: Protection of Wetlands	EPA, USCE, FWS, Louisiana Dept of Wildlife & Fisheries	d
Surface Mining Permit	LOCSMD	Pending
Compliance with Endangered Species Act of 1973 as amended	FWS	Biological assessment prepared
Compliance with the National Historic Preservation Act and Executive Order 11593	EPA, Louisiana SHPO, ACHP,	Memorandum of Agreement being drafted
Compliance with Archaeological and Historic Preservation Act of 1974	EPA, Louisiana SHPO, ACHP	Memorandum of Agreement being drafted
Compliance with Protection of Historic and Cultural Properties criteria	EPA, Louisiana SHPO, ACHP	Memorandum of Agreement being drafted
Compliance with Clean Air Act Section 110: Implementation Plans	EPA	Exempted

TABLE 3-1 (Concluded)

Permit, Regulation or Approval	Agency[a]	Status
Section 111: Standards of Performance for New Stationary Sources		
Air Emissions Approval	Louisiana Air Control Commission	Issued
Compliance with the Secretary's Memorandum No. 1827 Revised: Statement of Land Use Policy	USDA	d
Compliance with the Fish and Wildlife Coordination Act of 1934 as amended (1965)	FWS	d

a. Acronyms:
Environmental Protection Agency (EPA)
U.S. Corps of Engineers (USCE)
U.S. Fish and Wildlife Service (FWS)
State Historic Preservation Officer (SHPO)
Louisiana Dept. of Natural Resources (LDNR)
Advisory Council on Historic Preservation (ACHP)
U.S. Department of Agriculture (USDA)
Louisiana Office of Conservation, Surface Mining Division (LOCSMD)

b. Application not necessary at this time.

c. Not applicable unitl year 1987.

d. No process required.

4.0 DESCRIPTION AND EVALUATION OF ALTERNATIVES

4.1 NO ACTION ALTERNATIVE OF THE APPLICANT

Implementation of the no action alternative would mean that the site preparation, construction, and operation of the proposed project would not occur. If the proposed mine was not developed, environmental conditions within the permit area could potentially remain as they are now. However, in the four-parish project area (De Soto, Red River, Natchitoches, and Sabine), economic development is presently occurring and is expected to continue. Lignite development is rapidly becoming a major component of industrial activity; in De Soto Parish, lignite reserves are estimated at 546 million tons (Roland et al., 1976). Pursuit of mining activities in the general area will probably increase in-migration, housing needs, community service needs, income, etc. If the applicant does not mine the proposed permit area, another entity may wish to.

Without the mine, demands for electrical power within the respective service areas, will have to be reduced or met by other means. If service is reduced, future economic growth in the areas could be affected. If not reduced and the proposed mine is not constructed, the increased power needs would be supplied from the Dolet Hills Power Plant utilizing another fuel source, at higher costs passed on to the consumer.

4.2 ALTERNATIVE ENERGY SOURCES FOR THE DOLET HILLS POWER PLANT

On 2 June 1982, EPA issued a Notice of Intent to prepare an EIS on its NPDES permit action for the proposed Dolet Hills Power Plant. As a part of the environmental review, numerous energy source alternatives were considered for the power plant, including coal and petroleum gasification, natural gas, western coal, lignite, and nuclear power (EPA, 1981). Even though lignite has considerably more bulk than bituminous coal, and is, therefore, less economical to transport long distances, it was selected as the most economical energy source available to the Dolet Hills Power Plant and is therefore SWEPCO/CLECO's preferred alternative. After the completion of the environmental review, EPA issued the NPDES permit for the power plant on 25 June 1982.

4.3 DESIGN AND SITING OPTIONS FOR THE CONSTRUCTION AND OPERATION OF THE PROPOSED MINE

Through the analysis of numerous drill holes and lignite core holes, a lignite field containing 211.1 million recoverable tons of lignite has been identified.

4.3.1 Mine Layout Alternatives

The general area considered for surface mining trends in a northwest-southeast direction from just southeast of Rambin to just southeast of Mansfield. The band of lignite ranges from approximately 4.1 to 6.5 kilometers (2.5 to 4 miles) wide and is approximately 26.5 kilometers (16 miles) long. Numerous mine layout alternatives were considered along with mining equipment alternatives, mining methods, etc. Following the selection of a mining contractor, two mine layout alternatives within the general mine area were considered for implementation with the selected contractor's equipment, methods, etc.

4.3.1.1 Total Mining of the Dolet Hills Deposit

Mining all the lignite in the Dolet Hills deposit would involve operations within the Chemard Lake wetlands, an environmentally sensitive habitat on the eastern edge of the lignite deposit. Although 70 million tons of high quality lignite could be obtained from this area, mining would require operating in the Red River floodplain and 30 meters (100 feet) below the Red River's elevation, which could present dewatering and/or stability problems.

4.3.1.2 Partial Mining of the Dolet Hills Deposit

Partial mining of the Dolet Hills deposit would require mining some of the poorer quality lignite with thicker overburden. However, this plan would avoid the engineering, economic, and environmental costs associated with mining in the Chemard Lake area, and still allow for the cost-justified mining of two-thirds (141.1 million tons recoverable) of the available lignite. This amount of recoverable lignite would be sufficient to fuel the Dolet Hills Power Plant for the life-of-project, and thus the partial mining layout was selected.

4.3.2 Mine Operation Alternatives

Three alternative mining technologies can be used for coal or lignite extraction: (1) underground mining, (2) auger mining, and (3) surface mining.

4.3.2.1 Underground Mining

Underground mining of lignite is no longer practiced in the United States. Sediments overlying the mineable lignite are largely unconsolidated and would be extremely difficult to support safely and economically. The lignite seam is too thin to leave an appreciable thickness as roof material to provide sufficient vertical clearance for mining equipment and personnel. Mining recovery by the underground room and pillar technique averages about 50 percent of the recoverable resource compared with the typical 85 percent or better mining recovery by surface mining. Underground mining would cause subsidence of the ground surface resulting in shallow depressions. Due to these adverse technical factors, the anticipated high cost of underground mining, and the unnecessary waste of lignite, this mining method was judged as not suitable for the Dolet Hills Lignite Mine Project.

4.3.2.2 Auger Mining

Auger mining uses a horizontal boring-type machine to recover 20 to 30 percent of the coal resource, usually that remaining beyond the final cut highwall of a surface mine. This type of mining is most prevalent in steep-slope contour surface mines and has not been applied to any appreciable extent to surface lignite mining. Much of the reserve limit in the proposed mine area is defined by lignite that is either quite thin or of substandard quality. Final cuts delimited by depth of overburden beyond which lignite could be effectively recovered are excavated in only four places during the life of the project. Resource recovery and the area affected would be negligible. Keeping augering equipment and trained operating personnel on hand for such limited and occasional use would render the augering operation uneconomic. Keeping the final cut open until augering could be completed would hinder contemporaneous reclamation. This method is engineeringly and economically unsuitable for the proposed project.

4.3.2.3 Surface Mining

All lignite presently mined in the United States is surface mined. The lignite seam is exposed by excavating equipment, such as bucket-wheel excavators or draglines, and removed by power shovels, backhoes, front-end loaders, or continuous miners. After the lignite has been removed from the mine pit, the pit is backfilled with overburden material removed from the excavation of the next mining cut.

Surface mining will provide a maximum recovery level (normally ranging from 85 to 95 percent) of the proposed area to be mined. Also, the potential for ground-surface subsidence is minimal, allowing the mine site to be returned to its original or a higher land-use productivity. This alternative is the most technically sound and economical of those considered for lignite mining and is the choice of SWEPCO/CLECO for the Dolet Hills Lignite Mine Project.

4.3.3 Overburden Removal Alternatives

Three overburden removal methods are generally considered when operating a lignite surface mine: (1) draglines, (2) scrapers, and (3) bucket-wheel excavators.

4.3.3.1 Draglines

A dragline is an adaptation of a power crane for earth moving purposes. Draglines can operate from above the pit bottom level and work extremely well in consolidated overburden. As a stripping tool, it is difficult to match the dragline in terms of overburden removal cost compared to other overburden removal alternatives. However, draglines are built in different sizes, and one size dragline cannot work efficiently in both shallow and deep overburden depths.

4.3.3.2 Motorized Scrapers

Motorized scrapers are diesel powered stripping machines that look much like a road grader, except that they have a large carrying box located in the center of the machine. Scrapers are comparatively maneuverable, and are self-filling, but they lack the capacity of draglines or bucket-wheel excavators. A fleet of scrapers must be used to remove the large amounts of overburden required in a surface mine operation.

4.3.3.3 Bucket-wheel Excavators

A bucket-wheel excavator is primarily a large diameter wheel with buckets arranged around its circumference. It is usually operated with a conveyance system to transfer material. This type of machine works best in unconsolidated overburden where no hard rock formations are present. With the exception of some hard cemented sand lenses, the overburden in the Dolet Hills Lignite Mine Project area is well suited to bucket-wheel extraction. Also, the possibility of loss of lignite reserves by spoil failure poses less of a risk than a dragline operation because of the ability to place the overburden farther from the mining area when large amounts of overburden must be excavated. However, bucket-wheel excavators usually require a larger excavation than draglines, resulting in a larger pit, requiring the rehandling of more material to achieve near original contours in the postmining topography or more extensive reshaping of the land surface in the reclamation activities.

4.3.3.4 Combination

No single overburden removal method is best suited to the Dolet Hills Lignite Mine Project. The applicant has determined, after analyzing the alternatives, the safest, most cost effective, engineeringly feasible alternative is a combination of all three overburden removal methods. Draglines are the most cost efficient and can operate above the pit bottom. However, slope failure could occur below 21 meters (70 feet). When the overburden is over 21 meters (70 feet) deep, bucket-wheel excavators will be used to prestrip overburden down to a 21 meter (70-foot) bench, where the dragline will then operate. In island areas in the northwest section of the permit area, mining will be of a discontinous nature not justifying the installation of a bucket-wheel excavator system or a dragline, which are extremely large and complex machines that would have to be moved frequently. There, the smaller and more mobile motorized scrapers will be used.

4.3.4 Lignite Extraction Alternatives

Four lignite-loading methods are generally recognized: (1) power shovel, (2) front-end loader, (3) hydraulic backhoe, and (4) continuous miner.

4.3.4.1 Power Shovel

Power shovels are generally employed in the Gulf Coast lignite region for loading lignite. A high breakout force enables a power shovel to remove lignite without blasting or ripping. However, the geometry of the shovel is such that the use of this machine in relatively thin seams may result in poor lignite recovery and an unacceptable mixture of lignite and extraneous material. In addition, power shovels must load on the mine floor, which is unacceptable given soft bottom conditions expected in the Dolet Hills area. Therefore, this alternative was rejected.

4.3.4.2 Front-end Loader

Front-end loaders require good floor conditions to work efficiently since much of their breakout force is gained through driving into the face of the lignite seam. Further, good traction is required to minimize cycle times, and trucks must be loaded while on the mine-pit floor, which would be a clay base and present poor traction. This method was rejected as an alternative for the proposed project.

4.3.4.3 Hydraulic Backhoe

Throughout the United States, hydraulic backhoes are gaining acceptance as a primary lignite-loading method. The hydraulic backhoe is diesel powered and has both good mobility and the high breakout force necessary for digging lignite. When loaded by a hydraulic backhoe located on top of the lignite seam, trucks are not required to locate on the mine-pit floor, eliminating potential haulage problems caused by the soft bottom conditions expected at Dolet Hills. The hydraulic backhoe operator can also maneuver the bucket position to avoid loading waste material, while extracting virtually all the exposed lignite seam.

4.3.4.4 Continuous Miner

A continuous miner is a relatively new type of mining machine. The miner is a tracked vehicle with a large rotating drum. Spikes set in the drum strike and break out the lignite, deflecting it toward a conveyor system which loads the bottom dump trucks. This machine, until recently, has been unproven. However, recent use indicates that it is an effective and cost-efficient method for lignite removal.

4.3.4.5 Combination

The applicant has determined that the most efficient and economic lignite removal method would be a combination of the hydraulic backhoe and continuous miner, depending on site-specific mining conditions.

4.3.5 Lignite Transportation Alternatives

Three methods for transporting lignite to a mine-mouth power plant are generally utilized: (1) trains, (2) haul trucks, and (3) conveyors.

4.3.5.1 Trains

A rail system would require costly relocation as the mining areas advanced. In addition, rail systems are quite limited in grades that can be traversed. Some areas within the proposed permit area are topographically unsuitable due to the hilly terrain. A rail system would be economically and environmentally infeasible because of the necessary modifications to the topography, and because this type of conveyance system is economically suitable to longer hauls than those of the proposed project.

4.3.5.2 Haul Trucks

Haul trucks are often used in surface mining operations. They offer the advantage of mobility and flexibility over conveyors and trains, and mining can continue in the event that several trucks are being repaired. However, in the case of the proposed Dolet Hills surface lignite mine, the expense of maintaining 8 miles of haul roads to transport the lignite tonnages involved to the power plant would not be cost efficient, and no suitable road building material for heavy duty roads is available in the area. However, 70-ton dump trucks will be used to transport lignite short distances over haul-type roads from the active pits to a conveyor system.

4.3.5.3 Conveyors

The use of conveyors to transport lignite directly from the loading point to the power plant's lignite facility would provide a relatively continuous hauling system. Conveyors reduce the need of a complex and expensive road system and are much less expensive to relocate than a rail system as the mining sequence progresses.

4.3.5.4 Combination

A combination of a conveyor system and haul trucks is the applicant's preferred alternative. The conveyor system will transport lignite to the mine. Haul trucks will be used to transport lignite from the lignite removal point to central conveyor loading points.

4.3.6 Reclamation Alternatives

The following postmining land use reclamation alternatives were evaluated.

1) Area land use would be changed to primarily pasture rather than forest.
2) Area land use would be changed to primarily commercial forest.
3) Area land use will consist primarily of both managed and unmanaged forest with some restoration to pastureland, fish and wildlife habitat, and water resources.

The third alternative is the preferred alternative. This alternative most closely reflects project area landowner desires. Many of the landowner lease agreements require return of the land to either forest or pasture (Camp, 1982). In those disturbed areas where the applicant has the choice of selecting the postmining land use, the criteria used has been to return the land to its premining use (i.e., forest or pasture). Areas restored to a forest land use will be primarily commerical forest.

Three overburden handling alternatives were evaluated in consideration of postmining land use. These included: 1) no selective placement of preferred materials; 2) topsoil segregation and replacement; and 3) selective placement of sandy or oxidized overburden on the surface.

4.3.6.1 No Selective Placement

This alternative does not make use of the selective placement capabilities of the equipment proposed for use in mining operations. Random backfilling could result in undesirable materials on the surface which could impede reclamation success. Although this is the least expensive overburden handling alternative, it was rejected because of the lower probability of reclamation success and because it would not meet minimum Federal and State reclamation requirements.

4.3.6.2 Topsoil Segregation and Replacement

Most of the topsoil in the permit area consists of sandy or silty material in varying thicknesses. In areas where the topsoil is very thin, clayey materials underlie the topsoil. Segregation of topsoil layers less than 25 centimeters (10 inches) is not technologically feasible, as the underlying clayey material would also be removed during segregation procedures. In replacement of the topsoil, the mixture of sandy surface soil and clayey subsoil would provide a less suitable medium for reclamation than the existing soil layer (Harbert, 1982). In addition, an increased expense of this alternative would result from the costs required to transport material (topsoil and other suitable overburden) on wheels from its point of segregation to its needed point of deposition. Therefore, this alternative was rejected by DHMV because of the potential for lower productivity where thin topsoil layers occur, and because of the higher cost associated with the topsoil segregation and replacement procedure.

4.3.6.3 Selective Placement of Materials

Much of the lignite to be mined is immediately overlain by a layer of overburden with a high composition of unoxidized sandy material. This unoxidized sandy medium appears suitable for the establishment of pine forests, which is the intended postmining land use for most of the disturbed area. In areas where this unoxidized sandy zone is not found, near surface oxidized overburden is present which also has initially been demonstrated to be a suitable medium for pine seedling growth (Harbert and Draves, 1982). LOCSMD has been observing reclamation test plots for several years (Dolet Hills project), comparing the revegetation rates and productivity achieved by various overburden mixes and soil series. To date the oxidized overburden mixes appear to be comparable to the topsoil plots (Harbert and Draves, 1982). DHMV's proposed mining will allow for the selective placement of suitable oxidized materials. These overburden materials can be "selectively" placed with higher potential of reclamation than topsoil segregation and may also be handled more efficiently (and thus at lower cost) (Harbert, 1982). Therefore, DHMV's preferred overburden handling alternative is to selectively place the high percent unoxidized sandy material on the surface when present immediately above the lignite. In areas where the unoxidized sandy material is absent, near surface oxidized overburden will be placed on the surface.

4.3.7 Sanitary Waste Disposal Systems Alternatives

Three sanitary waste systems were considered for the proposed Dolet Hills Lignite Mine Project facilities: (1) existing sewage treatment plant; (2) septic tank; and (3) packaged plant. Sanitary waste will be treated at the main office and workshop, the field workshops, and the dragline erection site.

4.3.7.1 Existing Sewage Treatment Plant

The sewage treatment plant nearest the proposed mine ancillary facilities is located in Mansfield, approximately 9.6 kilometers (6 miles) to the west. Piping sewage this distance would be unacceptably costly, so this method of disposal was eliminated from consideration.

4.3.7.2 Septic Tank

A relatively large volume of sewage will be generated during both construction and operation of the mine. Although small-volume (residential) septic tank systems may be feasible given the soil conditions in the site area, the permanent ground-water level would affect the disposal of large volumes of wastes, resulting in adverse environmental effects. On these grounds, this waste disposal technique was deemed unsuitable.

4.3.7.3 Packaged Plant

A packaged extended aeration unit with secondary treatment is the sanitary waste disposal system chosen for use at the proposed Dolet Hills main office block and field complexes. The permanent sanitary waste disposal system will discharge to a nearby sedimentation pond. Maintenance and operation of this system will be performed by applicant. Portable chemical toilets will be used during construction. These portable facilities will be maintained and operated by the office-shop complex construction contractor. Portable chemical toilets will also be supplied for operators of equipment remote from office and workshop facilities.

4.4 DESCRIPTION OF APPLICANT'S PREFERRED ALTERNATIVE

The proposed Dolet Hills Lignite Mine Project, located in De Soto Parish, Louisiana (Figure 4-1) is a single-seam dragline/bucket-wheel excavator surface mining operation. The seam to be mined is designated the blue bed (Chemard Lake Lentil), however small amounts of an uppermost seam (yellow bed) exist and may be mined when encountered. Construction is scheduled to begin in July 1983, and mining will begin in late 1985. Full production will begin in 1986, and maximum production is scheduled in 1992. This will require two additional draglines (and shortly thereafter, bucket-wheel excavators), which will be used to increase production to approximately 5.64 million tons per year (mmtpy) for the remaining life of the mine. The average annual production will be 4.41 mmtpy for a total of 141.1 million tons recoverable over the 32-year life of the mine. All mining and reclamation activities will be performed according to Louisiana Office of Conservation, Surface Mine Division (LOCSMD) regulations for surface coal mining. The mine will be designed, constructed, and operated for SWEPCO/CLECO by the DHMV.

The total area that will be affected or potentially affected by mine operations is 11,968 hectares (29,573 acres). For purposes of discussion, this area will be considered to be the "permit" area for the life of mine assessment contained within this SEIS. Within the permit area, approximately 6,259 hectares (15,466 acres) will be directly affected by mining, 70.8 hectares (175 acres) will be affected by road construction, 65.5 hectares (162 acres) will be affected by the conveyor system, 72.8 hectares (180 acres) will be disturbed by mine facilities such as the main office and field workshops, dragline erection will disturb 4.5 hectares (11 acres), stream diversions (outside of mining block, but within the permit area) will affect 11.2 hectares (27.8 acres), and permanent sedimentation ponds will disturb 27.6 hectares (68 acres). The remaining 5,467.9 hectares (13,511 acres), outside the mining blocks and ancillary areas but within the permit area, may be affected.

An average of 195.5 hectares (483 acres) will be mined on an annual basis for the life of the mine (1985-2017). The average number of hectares per year that will be disturbed by clearing, mining, and reclamation (1986-2017) will be 280.5 (693 acres). The average number of hectares that will be ungraded per year (disturbed or exposed) during the life of the mine will be 367.9 (909 acres). The maximum number of hectares that will be ungraded (disturbed or exposed) per year (2001-2008) will be approximately 485.6 hectares (1,200 acres). The estimated annual disturbed areas can be found in Table 4-1.

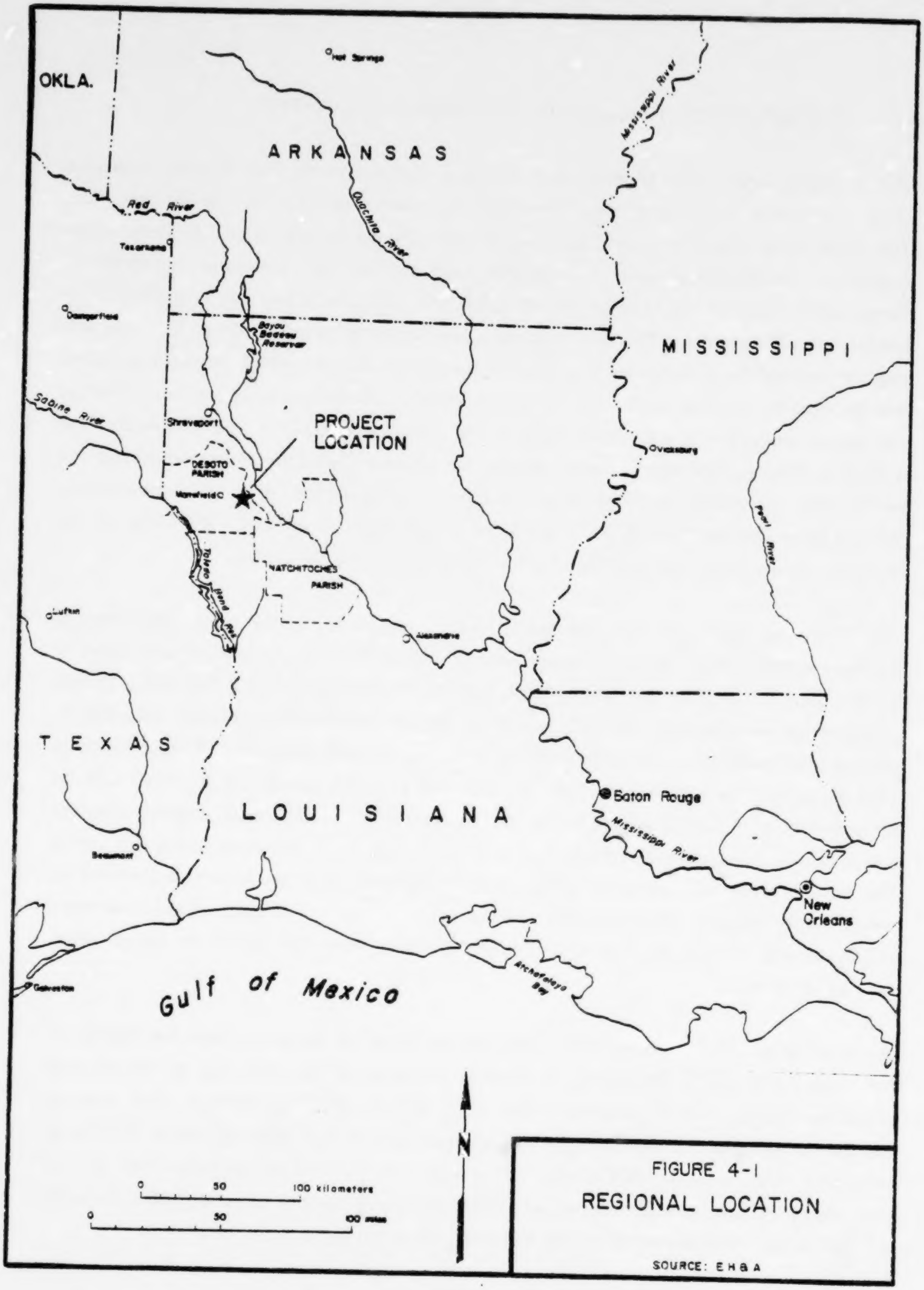

OKLA.
Hot Springs
ARKANSAS
Mississippi River
Red River
Texarkana
Ouachita River
Daingerfield
Bayou Bodcau Reservoir
MISSISSIPPI
Sabine River
Shreveport
PROJECT LOCATION
DESOTO PARISH
Mansfield
Vicksburg
NATCHITOCHES PARISH
Toledo Bend Res.
Pearl River
Lufkin
Alexandria
TEXAS
LOUISIANA
Baton Rouge
Mississippi River
Beaumont
New Orleans
Galveston
Gulf of Mexico
Atchafalaya Bay
N
0 50 100 kilometers
0 50 100 miles

FIGURE 4-1
REGIONAL LOCATION

SOURCE: EH&A

TABLE 4-1

ESTIMATED ANNUAL DISTURBED AREAS[a]

Year	Acres Mined[b]	Total Acres Disturbed by Mining	Acres Disturbed by Ancillary Facilities	Total Acres Disturbed	Total Acres Regraded	Net Acres Ungraded
1984	--	--	221	221	--	221
1985	--	--	4	4	--	225
1986	326	605	0	605	454	376
1987	378	609	30	639	631	384
1988	286	470	26	496	532	348
1989	296	558	26	584	562	370
1990	290	295	35	330	394	306
1991	341	345	4	349	344	311
1992	332	468	59	527	483	355
1993	643	1,158	59	1,217	1,045	527
1994	571	1,086	0	1,086	1,118	495
1995	687	854	0	854	912	437
1996	674	679	0	679	723	393
1997	680	865	0	865	819	439
1998	648	731	3	731	765	405
1999	546	567	0	567	608	364
2000	644	800	20	820	757	427
2001	634	771	0	771	783	415
2002	621	808	0	808	799	424
2003	639	751	0	751	765	410
2004	595	669	0	669	690	389
2005	624	700	0	700	692	397
2006	601	612	0	612	634	375
2007	632	700	0	700	678	397
2008	706	710	45	755	741	411
2009	573	776	0	776	770	417
2010	533	647	0	647	679	385
2011	233	317	0	317	400	302
2012	226	284	0	284	292	294

TABLE 4-1 (Concluded)

Year	Acres Mined[b]	Total Acres Disturbed by Mining	Acres Disturbed by Ancillary Facilities	Total Acres Disturbed	Total Acres Regraded	Net Acres Ungraded
2013	250	422	0	422	388	328
2014	264	352	8	360	376	312
2015	257	260	0	260	285	287
2016	250	299	2	301	291	297
2017	257	260	0	260	270	287
2018	--	--	--	--	287	--

a. Within 2 percent accuracy.

b. See conversion chart for metric equivalent.

Source: DHMV.

4.4.1 Ancillary Facilities

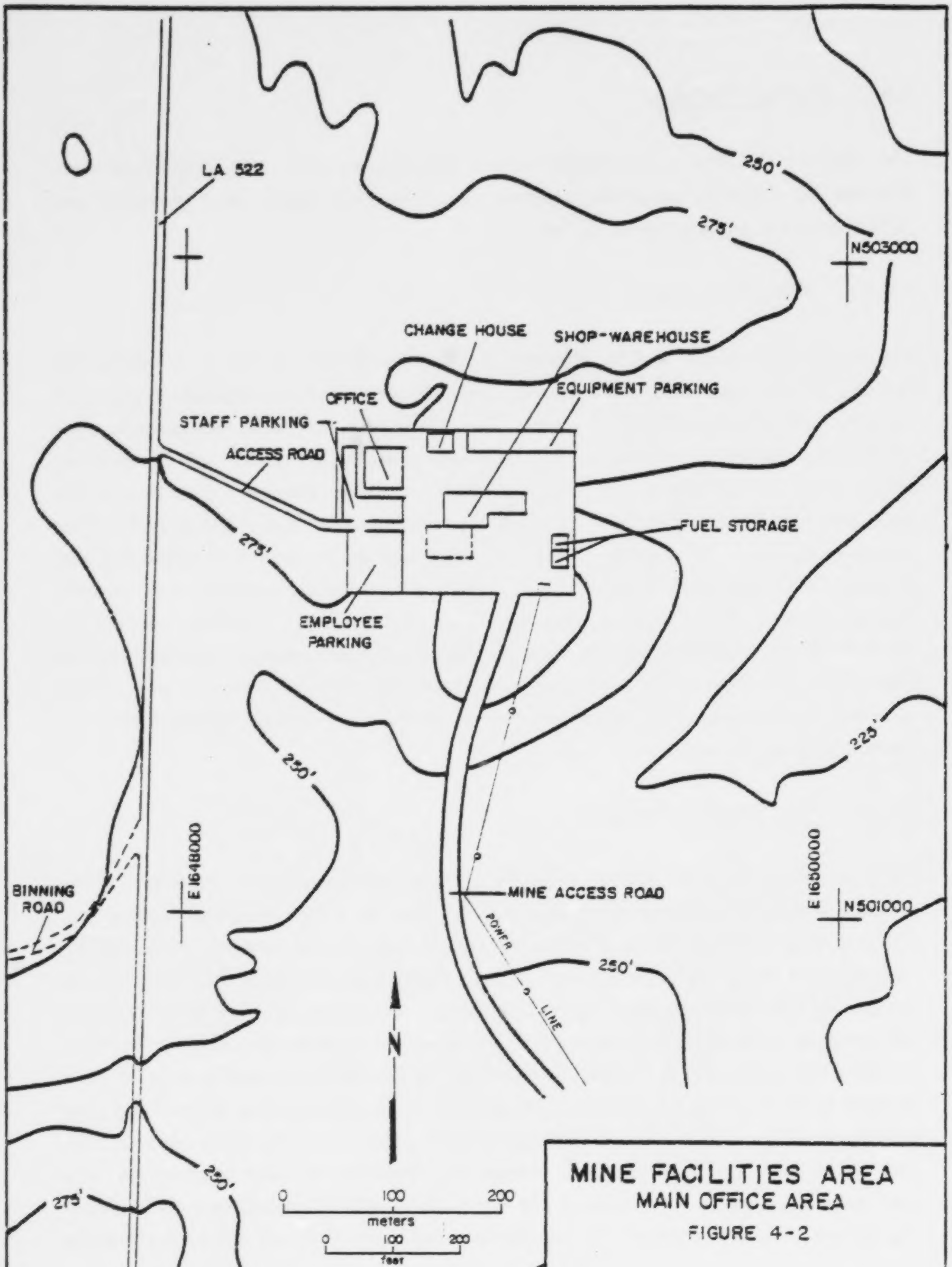
The ancillary facilities to be constructed with the proposed mine are a main office block (Figures 4-2 and 4-3), equipment erection sites, two field workshops (Figures 4-4 and 4-5), haul roads, and a conveyor system.

4.4.1.1 Main Office Block

The main office block will be adjacent to LA Hwy. 522 in Section 7, Township and Range 12N 12W (northwest area of mine). The main warehouse and engineering workshop facilities will be erected in this vicinity. The office block will house management, mine engineering, and other personnel. The engineering workshop facility will be used for major repairs to equipment, and upkeep of machinery. Fuel supplies will be held at the main office block; two 189,250-liter (50,000-gallon) tanks for diesel and a 22,710-liter (6,000-gallon) tank for gasoline. The fuel tanks will be surrounded by dikes and will conform to all applicable State and local regulations. A Spill Prevention and Countermeasure Control Plan will also be prepared by the applicant. Parking lots will be constructed for mine personnel and visitors. Normal domestic sewage treatment will be installed at the main office block (see Section 4.4.1.7). Run-off from the area will be directed into sedimentation ponds and treated as necessary before discharge into the general drainage system.

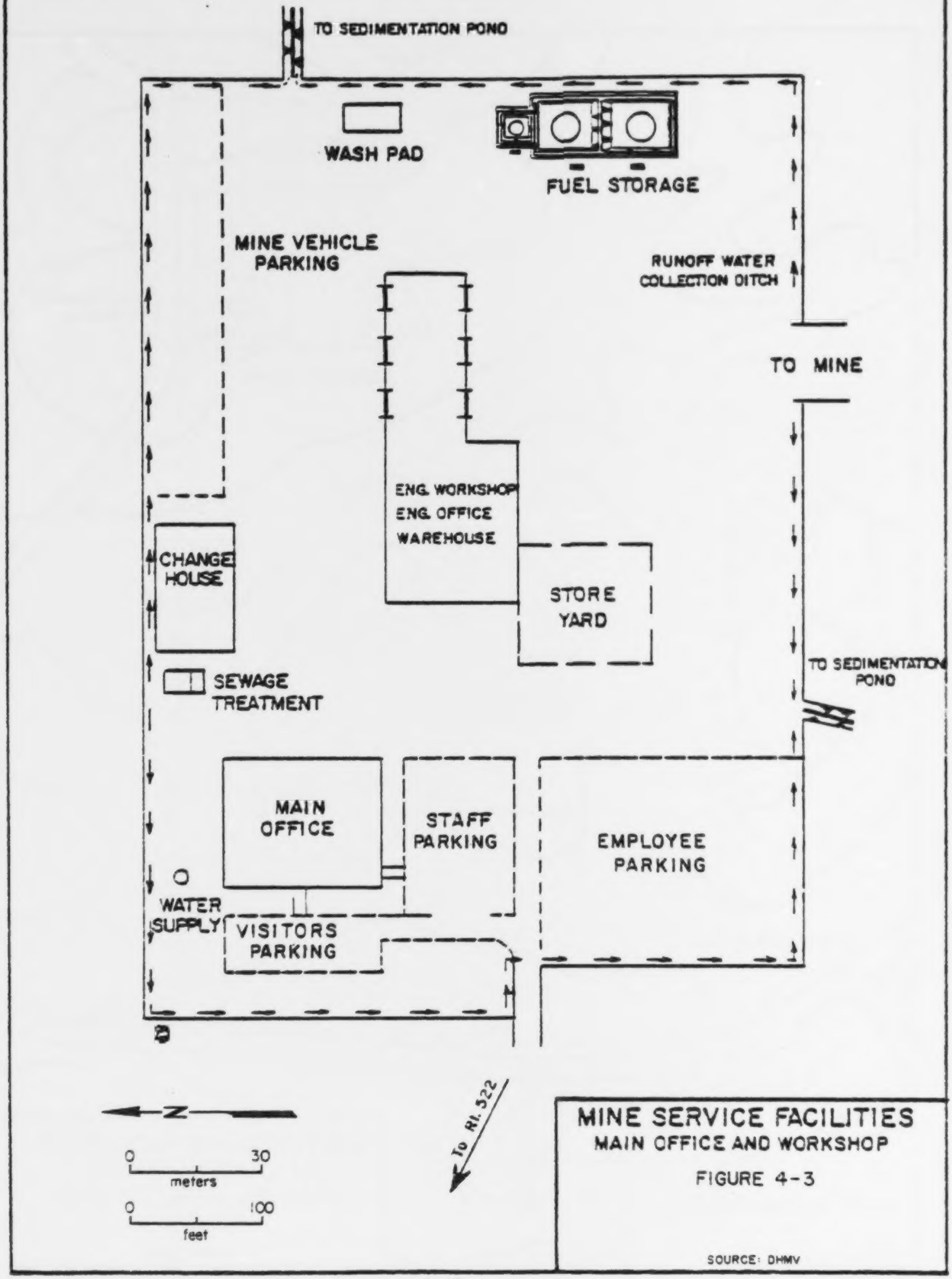
4.4.1.2 Field Workshop Facilities

Field workshop facilities will be provided in three locations. The site used for the erection of the first dragline will subsequently be used for a field workshop facility site. Other similar facilities will be provided at various stages in the mine life in Section 35, Township and Range 12N 12W (central area of the mine), and Section 32, Township and Range 12N 12W (western area of the mine), adjacent to Highway 175. The field workshops will comprise mechanical and electrical servicing and minor repair and welding facilities. Dragline and bucket-wheel excavator repairs will be carried out in mobile shops situated as close to the machines as possible. Fuel supplies to be maintained at each of the field workshops will be held in two 189,250-liter (50,000-gallon) tanks for diesel and a 22,710-liter (6,000 gallon) tank for gasoline. Storage for lubricants will also be provided. The fuel tanks will be surrounded by dikes and will conform with all applicable State and local regulations. A Spill Prevention and Countermeasure Control Plan will also be prepared by


LA 522
250'
275'
N503000
CHANGE HOUSE
SHOP-WAREHOUSE
EQUIPMENT PARKING
OFFICE
STAFF PARKING
ACCESS ROAD
FUEL STORAGE
275'
EMPLOYEE PARKING
250'
225'
E1648000
E1650000
N501000
BINNING ROAD
MINE ACCESS ROAD
POWER LINE
250'
N
250'
275'
0
100
200
meters
0
100
200
feet

MINE FACILITIES AREA
MAIN OFFICE AREA
FIGURE 4-2

SOURCE: DHMV

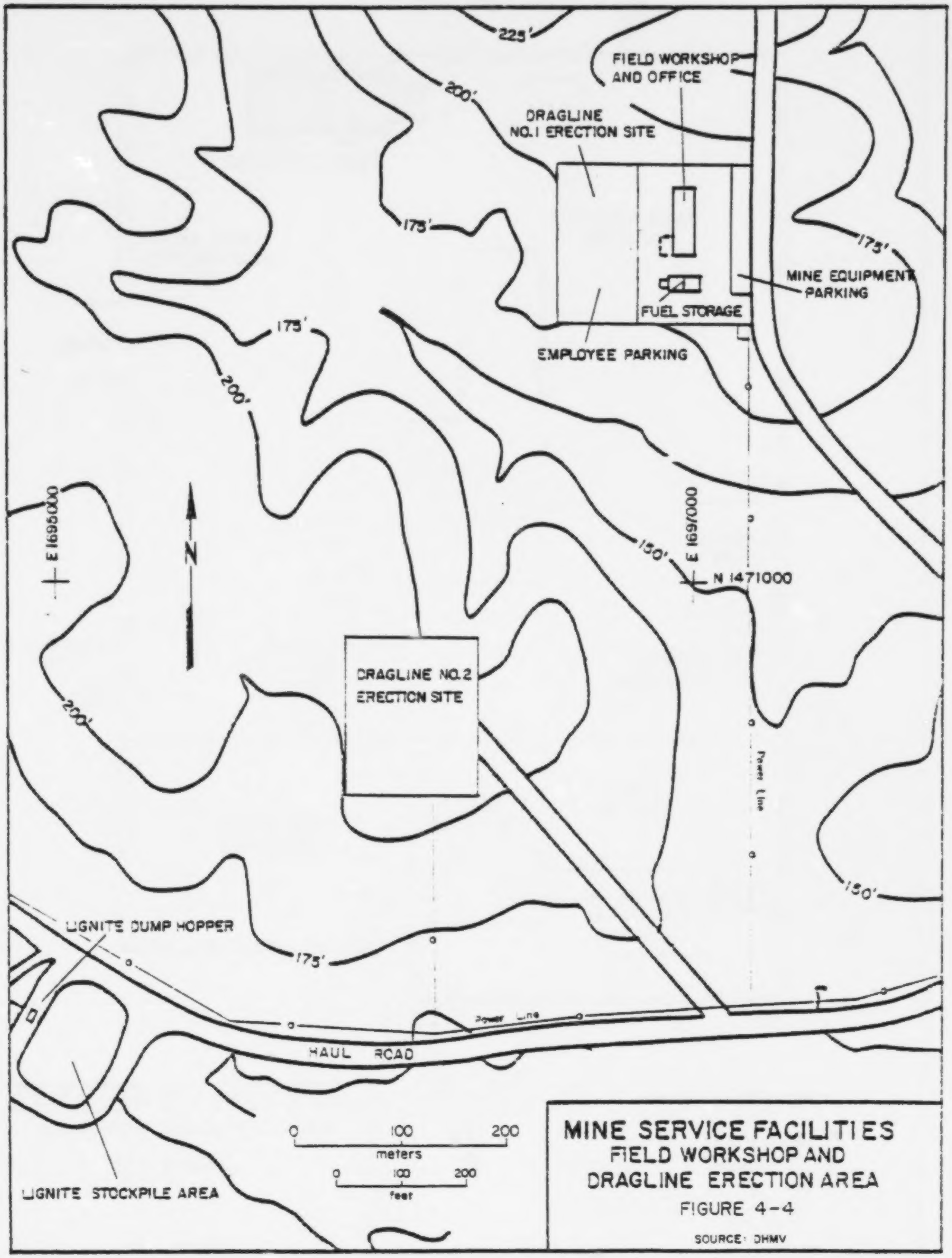


TO SEDIMENTATION POND
WASH PAD
FUEL STORAGE
MINE VEHICLE PARKING
RUNOFF WATER COLLECTION DITCH
TO MINE
ENG. WORKSHOP
ENG. OFFICE
WAREHOUSE
CHANGE HOUSE
STORE YARD
SEWAGE TREATMENT
TO SEDIMENTATION POND
MAIN OFFICE
STAFF PARKING
EMPLOYEE PARKING
WATER SUPPLY
VISITORS PARKING
To Rt. 322
N
0
30
meters
0
100
feet

MINE SERVICE FACILITIES
MAIN OFFICE AND WORKSHOP

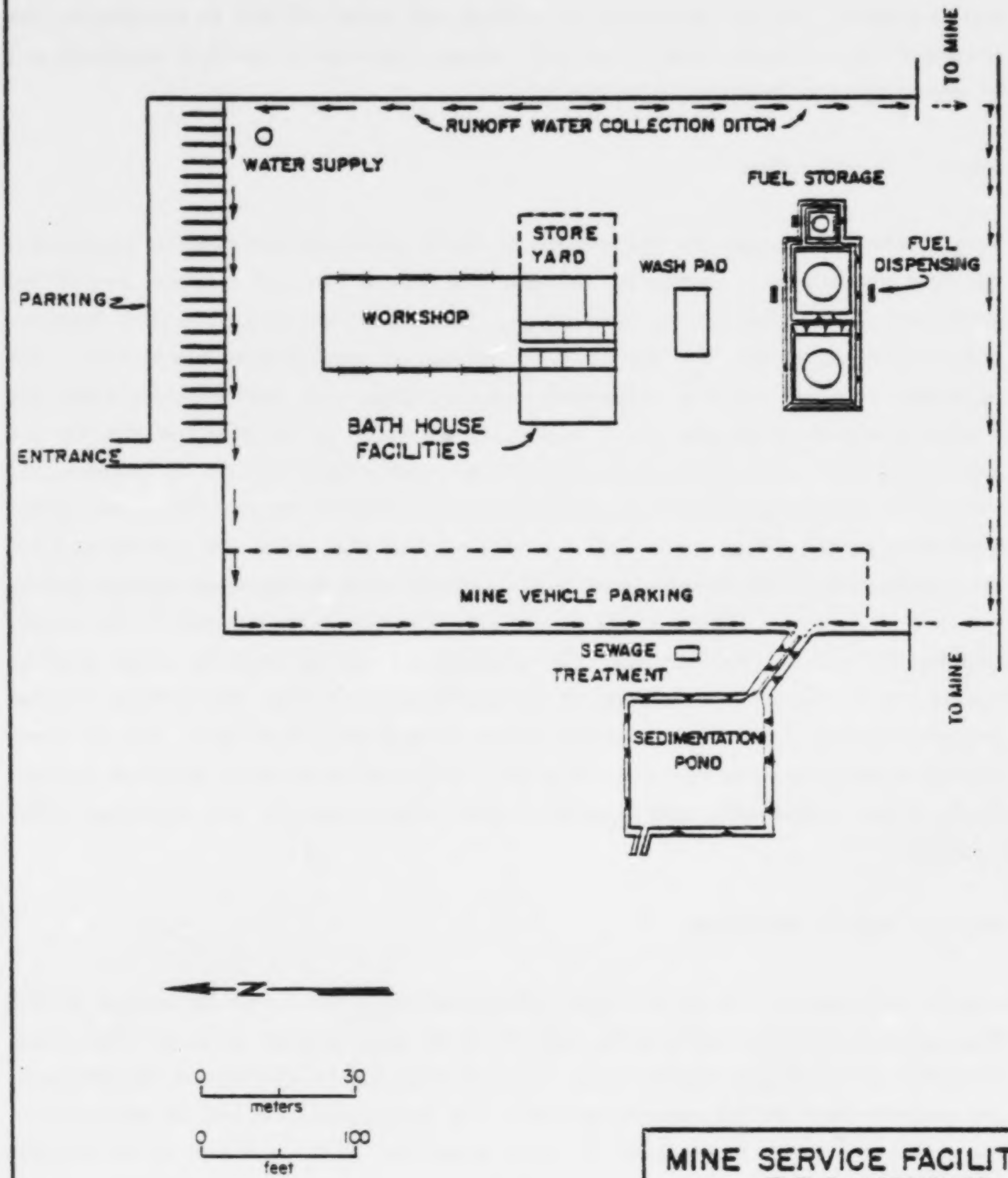
FIGURE 4-3

SOURCE: DHMV


225'
FIELD WORKSHOP AND OFFICE
200'
DRAGLINE NO.1 ERECTION SITE
175'
175'
MINE EQUIPMENT PARKING
FUEL STORAGE
175'
EMPLOYEE PARKING
200'
E 1695000
N
E 1697000
150'
N 1471000
DRAGLINE NO.2 ERECTION SITE
200'
Power Line
150'
LIGNITE DUMP HOPPER
175'
Power Line
HAUL ROAD
0
100
200
meters
0
100
200
feet
LIGNITE STOCKPILE AREA

MINE SERVICE FACILITIES
FIELD WORKSHOP AND
DRAGLINE ERECTION AREA
FIGURE 4-4

SOURCE: DHMV


TO MINE
RUNOFF WATER COLLECTION DITCH
WATER SUPPLY
FUEL STORAGE
STORE YARD
WASH PAD
FUEL DISPENSING
PARKING
WORKSHOP
BATH HOUSE FACILITIES
ENTRANCE
MINE VEHICLE PARKING
SEWAGE TREATMENT
TO MINE
SEDIMENTATION POND
N
0
30
meters
0
100
feet

MINE SERVICE FACILITIES
FIELD WORKSHOP

FIGURE 4-5

SOURCE: DHMV

the applicant. The field workshops will house offices for supervisory personnel, the operation and maintenance workforce, and have a small parts warehouse. Parking space will be provided both for employees and visitors, and space will also be provided for the storage of mine equipment (see Figure 4-5). Sewage treatment at the field workshops will be identical to that described in Section 4.4.1.7.

4.4.1.3 Erection Sites

Several sites will be used for the erection of the draglines and bucket-wheel excavators. The first site will be in Section 10, Township and Range, 11N 11W (eastern area of the mine), and will be used for the erection of a 57.3 cubic meter (75 cubic yard) dragline, other mining equipment, and the conveyor stations as required (see Figure 4-4). The equipment required for site preparation, road building, and sedimentation pond and diversions will be off-loaded, and if necessary, assembled at the proposed site for the main office block. A second erection site will be constructed in Section 10, Township and Range 11N 11W (eastern area of the mine) and will be used for the erection of the second dragline to be brought on line in 1987. A third erection site, which will later be used for the construction of the bucket-wheel excavators and cross pit conveyor bridges will be provided in Section 2, Township and Range 11N 12W (south-central area of the mine). This facility will be required from 1991 onwards and will be used for major dragline repairs and for dismantling machines at the end of the mine life. The surfaces of these erection sites will be elevated for good drainage, compacted, and surfaced. The site areas have been placed to take advantage of public transportation routes to facilitate delivery of equipment components, and to provide good mine routes for the equipment after erection.

4.4.1.4 Lignite Haul Roads

Lignite haul roads will be of the Class I type as defined in the Louisiana Surface Mining Regulations (LSMR) 216.150/216.154, and will be designed to meet all sound engineering principles and regulatory requirements. The haul roads will be 15.2 meters (50 feet) wide and generally be of the fill embankment type. The lignite haul roads will be utilized from the active pits to the truck dump locations where the lignite is placed on an overland conveyor, via loading hoppers and primary crushers.

4.4.1.5 Conveyor System

An overland conveying system will be used to handle the lignite from the lignite loading hoppers to the power plant after transport from the mine by truck. The initial overland conveyor will be 12.8 kilometers (8 miles) long and will be paralleled by an access road. The conveyor will be of a design to allow for ease of erection and dismantlement to facilitate relocation to different mining areas as mining progresses. The conveying system will provide a cost-effective method for the transfer of lignite while reducing haul road aggregate requirements and fugitive dust. Surface area affected by the entire conveyor system for the life of the mine will be 65.5 hectares (162 acres).

4.4.1.6 Electric Transmission Lines

A 230 kV electric transmission line will be erected between the power plant and the mine's main substation which is not located within the permit area. From there, various lines will be routed to the electrically powered mining equipment, and mine facilities. All electric lines will be erected along access roads.

4.4.1.7 Waste Treatment

Domestic sewage from the main office block and the two field complexes will be treated by three packaged extended aeration units with secondary treatment, before being discharged into a sedimentation pond. The three units combined will treat approximately 8,516 liters (2,250 gallons) of wastewater per day. Before entering the sedimentation pond, the wastewater will meet the NPDES permit requirements for total suspended solids (daily average, 30 mg/l; daily maximum, 45 mg/l) and 5-day biological oxygen demand (BOD) (daily average, 30 mg/l; daily maximum, 45 mg/l) (see page 4 of Appendix A).

Wastewater produced by equipment washing will be treated in an oil separating unit before release into the sedimentation pond. Wastewater will also meet the NPDES permit requirements before release from the sedimentation pond downstream.

4.4.2 Mineable Reserves

Through an analysis of 2,498 drill holes and 150 lignite core holes, an economically recoverable deposit containing approximately 141.1 million tons of lignite has been identified within the permit area. The mineable seam thickness averages 1.8 meters (6.1 feet). The anticipated mining recovery percentage is 92 percent. Average lignite quality will be:

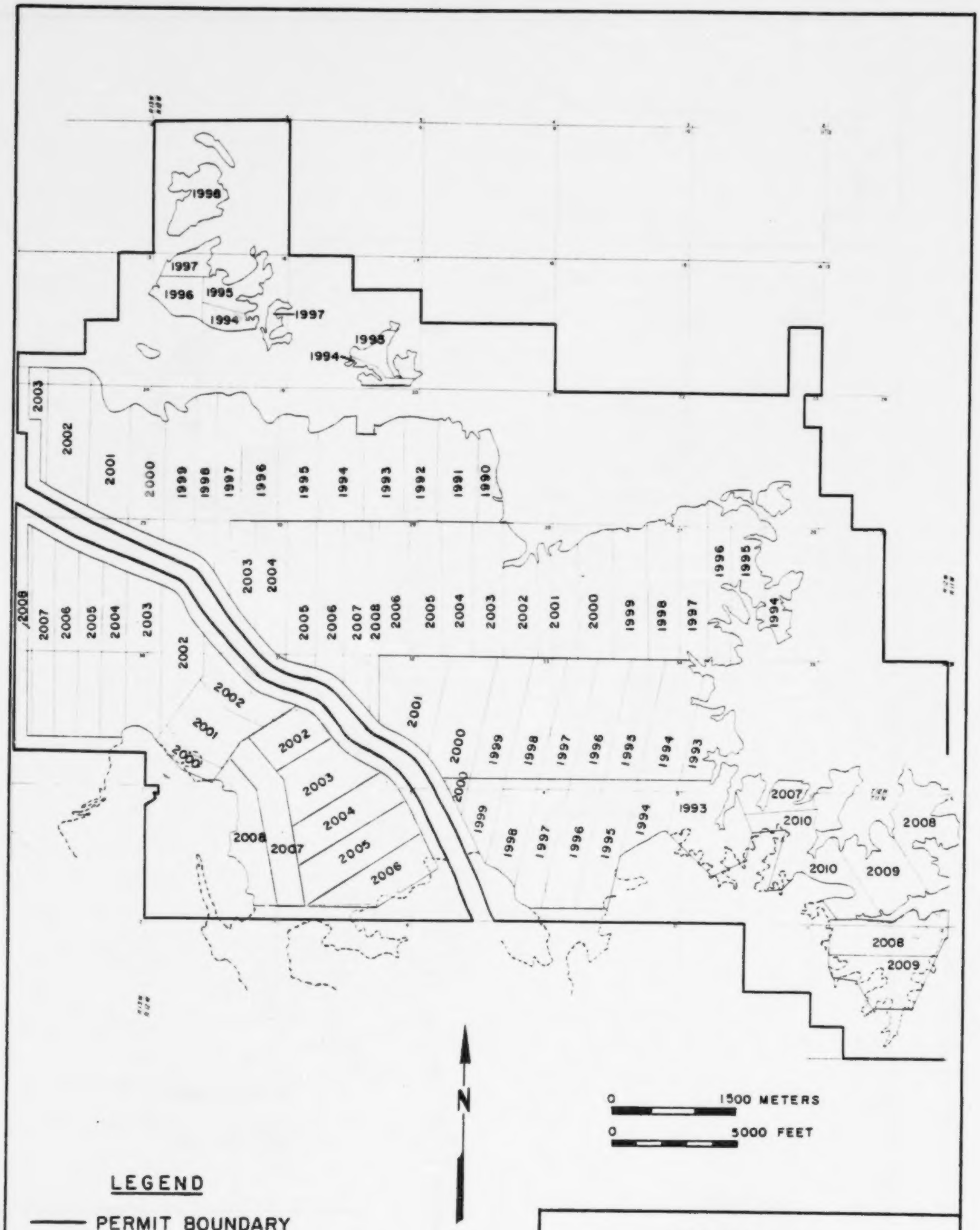
Blue Seam (As-mined Quality)	Percent by Weight
Moisture	31.0
Ash	11.8
Sulfur	0.7
BTU	7,247/lb.

4.4.3 Mining Sequence

A mining sequence was developed to provide the design tonnage (Figure 4-6). Criteria used in selecting the mining sequence include:

- Selecting the shallowest overburden for mining first, then excavating thicker material as mining progresses;
- Minimizing the number of dragline moves and box-cut yardage;
- Minimizing disruption of the natural drainage system consistent with maximum recovery of the lignite resource;
- Reducing the amount of haul road surface through the use of overland conveyors.

The initial mining operation will commence in late 1985 in the eastern part of the site as indicated on the mining sequence plan (Figure 4-6). These operations will generally move from east to west in the eastern portion of the mine in the early years, from east to west in the middle years of the mine, and from north to south in the eastern portion in the later years of mine life. The operations will be carried out using two stripping and mining units. The units will work together in the eastern area for a period of four years when the unit designated as U2 will be moved into the northern part of the western area. Mining will continue in both east and west areas for a further period of four years when the second power plant unit is scheduled to come on-line. At this time two additional stripping and mining units will be added to the fleet. The four stripping and mining units are planned to be of similar size. A year later, in 1994, the unit U1 will move to the western area, and all operations will be concentrated in this area for a period of 14 years (until 2008). The stripping and mining units will then revert to the eastern section,


1998
1997
1996
1995
1994
1997
1995
1994
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
2003
2004
2008
2007
2006
2005
2004
2003
2002
2005
2006
2007
2008
2006
2005
2004
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
2002
2001
2000
2002
2003
2004
2005
2006
2008
2007
2001
2000
1999
1998
1997
1996
1995
1994
1993
2000
1999
1998
1997
1996
1995
1994
1993
2007
2010
2008
2010
2009
2008
2009
N
0
1500 METERS
0
5000 FEET

LEGEND

PERMIT BOUNDARY

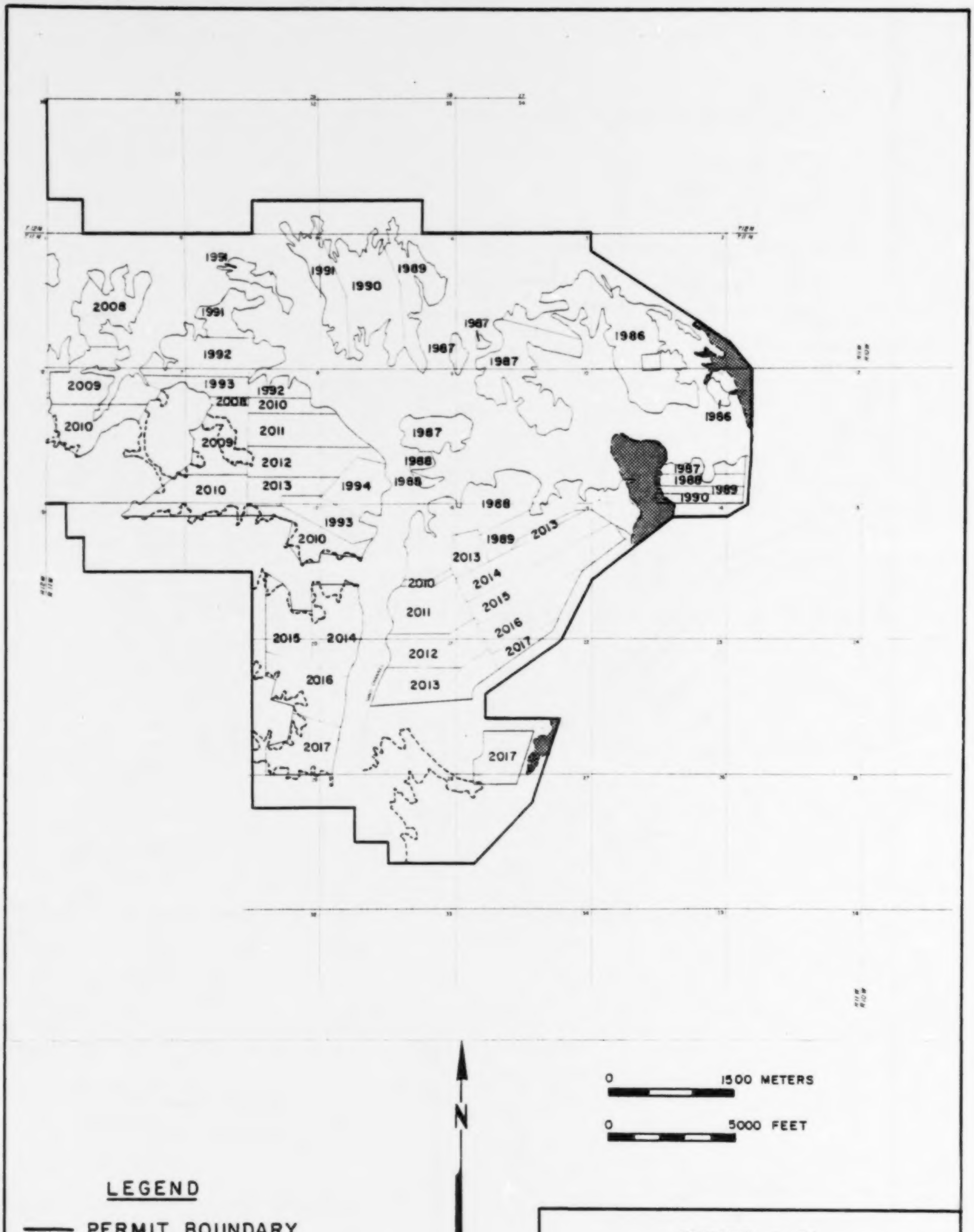
MINE BOUNDARY

OVERBURDEN ISOPACH 140' OR SUBCROP

FIGURE 4-6a

MINING SEQUENCE
West Area

SOURCE: DHMV


1991
1991
1990
1989
2008
1991
1987
1986
1992
1987
1987
2009
1993
1992
2008
2010
1986
2010
2011
1987
2009
2012
1988
1987
1988
1989
2010
2013
1994
1988
1990
1988
1993
1989
2013
2010
2013
2014
2010
2015
2011
2016
2015
2014
2017
2012
2016
2013
2017
2017
N
0
1500 METERS
0
5000 FEET

LEGEND

— PERMIT BOUNDARY

— MINE BOUNDARY

----- OVERBURDEN ISOPACH 140' OR SUBCROP

▨ USCE DELINEATED WETLANDS

FIGURE 4-6b

MINING SEQUENCE
East Area

SOURCE: DHMV

retreating in an easterly direction until 2017 when the operations envisaged will be complete. A schedule of operation for major equipment is listed in Table 4-2.

4.4.4 Mining and Equipment Methods

4.4.4.1 Major Mining Equipment

The proposed mine will use conventional single-seam mining procedures to remove the blue-bed seam. However, consideration will be given to the extraction of lignite from the overlying yellow bed where feasible and economical. The equipment to be used on overburden stripping operations will be draglines, motorized scrapers, and bucket-wheel excavators with cross pit conveyors. The draglines and bucket-wheel excavators will be electrically operated. This equipment will be assisted by the normal tracked dozer equipment.

The equipment to be used for lignite excavation will be hydraulic backhoes with a bucket capacity of 10.7 cubic meters (14 cubic yards) or continuous miners. Ancillary equipment will be provided to assist in all mining and stripping operations as required. The types and numbers of major mining equipment to be used are listed in Table 4-3.

4.4.4.2 Land Clearing

Land clearing will be carried out when required in advance of the stripping and mining operations. During the land clearing phase, timber and brush will be removed, the merchantable timber being felled and sold by the lessors or by a local contractor working for the miner. When all useable timber has been removed, the remaining vegetation and other refuse will be dozed into piles or windrows and disposed of or burned in accordance with the Louisiana Air Quality Division regulation 11.3.8.

4.4.4.3 Overburden Removal

The overburden depth within the mining blocks varies in thickness from 6 to 42.6 meters (20 to 140 feet). Overburden will be removed in one or two stages, depending on overburden thickness. The two stages are a prestrip operation by bucket-wheel excavators and/or scrapers in areas where overburden exceeds a thickness of 21 meters

TABLE 4-2

SCHEDULE OF OPERATION OF MAJOR EQUIPMENT[a]

Dragline No. 1	Last Quarter 1985
Dragline No. 2	Last Quarter 1986
Dragline No. 3	Last Quarter 1992
Dragline No. 4	Last Quarter 1992
Bucket-wheel Excavator No. 1	Last Quarter 1993
Bucket-wheel Excavator No. 2	First Quarter 1994
Bucket-wheel Excavator No. 3	First Quarter 1994
Bucket-wheel Excavator No. 4	First Quarter 1996
Bucket-wheel Excavator No. 5	Second Quarter 1996
Cross Pit Conveyor Bridge No. 1	Last Quarter 1993
Cross Pit Conveyor Bridge No. 2	First Quarter 1994
Cross Pit Conveyor Bridge No. 3	First Quarter 1996
Hydraulic Backhoe No. 1	Last Quarter 1985
Hydraulic Backhoe No. 2	Last Quarter 1986
Hydraulic Backhoe No. 3	Last Quarter 1992
Hydraulic Backhoe No. 4	Last Quarter 1992
Haul Trucks 7	Last Quarter 1985
Haul Trucks 7	First Quarter 1993

---

[a] Ancillary equipment for road building, site preparation, etc., will be in operation from July 1983 onwards.

TABLE 4-3

MAJOR MINING EQUIPMENT

1.	Dragline (57.3 cubic meter (75 cu. yd.) capacity buckets)	4
2.	Bucket Wheel Excavators (600 - 650 liter size)	5
3.	Cross pit conveyor bridges	3
4.	Lignite loaders	4
5.	Conveying System	12.8 kilometers (8 miles) in length
6.	70-Ton Bottom Dump Coal Hauler	14
7.	Dozers (D9 type)	6
8.	Dozers (D8 type)	6
9.	Motorized Scrapers	6
10.	Front End Loader	2
11.	Hydraulic Back Hoes	2
12.	50-Ton Rear Dump Trucks	6
13.	Rubber Tired Dozers	4
14.	Graders	6
15.	Water Trucks	4

(70 feet), and then the primary or lignite uncovering operation will proceed using draglines except possibly in the island area to the northwest where motorized scrapers may be used.

The draglines used in the primary stripping operations will in general remove overburden to a depth not exceeding 21 meters (70 feet), a height deemed to satisfy conditions of no deliberate rehandling of material, and to alleviate spoil pile failures due to excessive amounts of material being placed too close to the mining face, and also to reduce high-wall spalling and minor failures. The material from the bucket-wheel excavators will be transported across the pit by conveyor and then placed by slewing stackers at least two spoil piles back from the latest active pile. Dragline spoil will be placed directly into the latest open and completed mining face area.

4.4.4.4 Lignite Loading and Hauling

Lignite will be loaded in the mine area using backhoes, or a continuous miner. The machines will load directly into 70-ton bottom coal haulers. It is not considered necessary to drill and blast the lignite, and should any breakage be required in the ground, this will be accomplished by using rippers on tracked vehicles already in use in other operations, rather than by blasting.

The bottom dump trucks will travel from the loading point in the mine to a conveyor loading facility located as close as possible to the active mine face. The conveyor loading stations will be located in positions central to the mining operations or groups of operations to minimize truck haulage distances from the mine to the hopper. This facility will consist of a loading hopper with a feeder breaker where the lignite will be broken to <15 centimeters (<6 inches) with the feeder breaker loading directly onto a conveyor for transportation to the plant hopper. The loading hopper site will be so designed that the area will have the capability of holding a temporary lignite stockpile which could be easily pushed into the loading hopper. The conveyor will transport the lignite directly to the power plant hopper where a raised discharge and front-end loaders will facilitate the building of an emergency mine stockpile.

The lignite cleaning or capping operations will be carried out using rubber-tired dozers with graders to assist, and front-end loaders and rear dump trucks to clean up spillage from the spoil piles and high walls. Dozers, graders, and rollers will be employed on road maintenance.

Lignite stockpiles will be limited to 100,000 tons maximum at the delivery end of the conveyor and active stockpiles at conveyor loading points. The 100,000-ton stock will be compacted in layers to minimize air voids. It will be sealed with a bituminous spray if spontaneous combustion appears possible. Active stockpiles will not be in place long enough to generate heat to the point of combustion.

As lignite will not be blasted prior to excavating, the risk of spontaneous combustion in the lignite bed will be eliminated.

4.4.4.5 Spoil Grading

The spoil grading operations will be classed broadly into two types; those necessary for the grading of dragline spoil piles, and those necessary for the grading of the bucket-wheel stacker piles. Any overburden removal by motorized scrapers will generally include regrading as the stripping operations progress.

The grading of the dragline spoil piles will be carried out conventionally, that is by a dozer levelling off the piles just behind the active spoil pile. The bucket-wheel excavator piles will require far less regrading than the dragline spoil piles as the operation of the spreader itself relieves the grading machines of much of the work.

4.4.4.6 Drainage and Erosion Control

Sedimentation Ponds. Throughout the life of the mine, sediment control ponds (107 temporary and 9 permanent) will be constructed to receive and detain the runoff from the disturbed areas (Figure 4-7a and b) and will be designed and constructed according to LSMR regulations 216.45/216.49. It is anticipated that three types of sediment control structures will be used. Type I (Figure 4-8) is a sedimentation pond consisting of an embankment with principal and emergency spillways. The design specifications for the Type I Sedimentation Pond are detailed in the figure. This pond type will be used in natural drainageways near the head of small drainage areas. The Type 2 Sedimentation Pond (Figure 4-9) is an excavated pond to be located, as needed. The outlet will provide a theoretical 24-hour detention time for a 10-year, 24-hour precipitation event with buffers and 0.1 acre-feet of sediment storage capacity to provide sediment removal and storage for each acre of disturbed area. The Type 3 Sedimentation Pond (Figure 4-10) is a combination of excavated and embankment types. Pond types 2

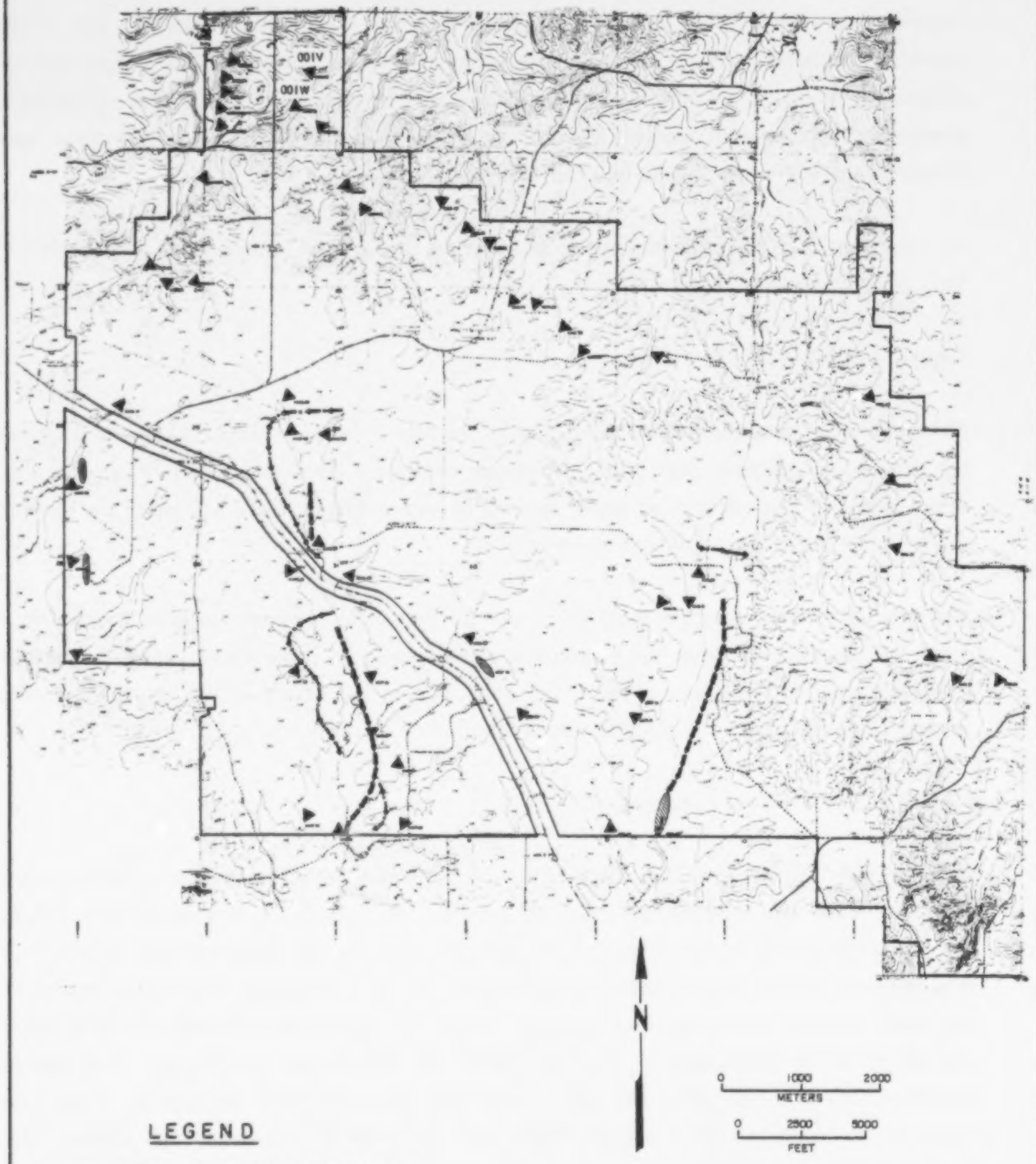
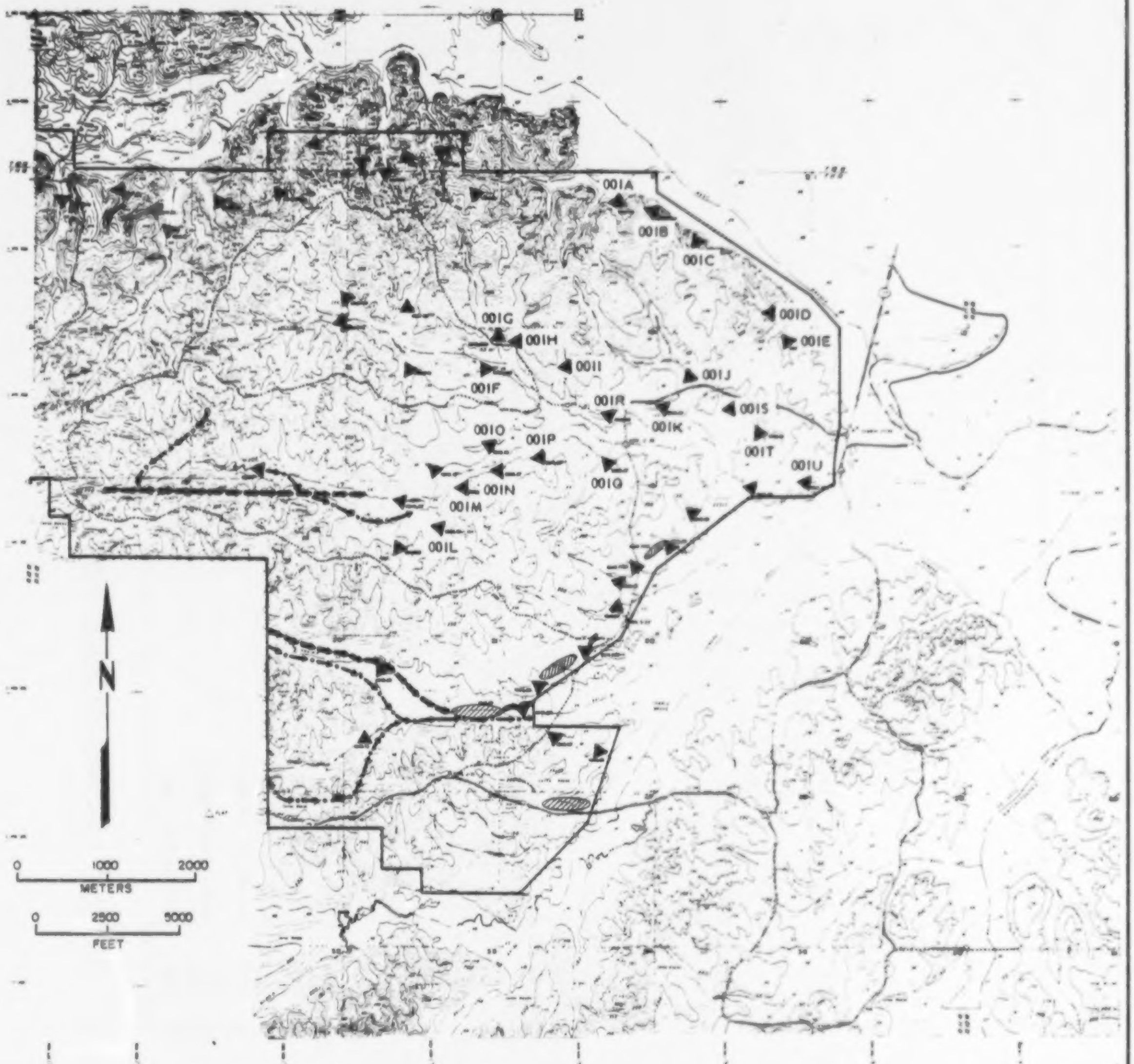

001V
001W
N
0 1000 2000
METERS
0 2500 5000
FEET
LEGEND
PERMIT AREA BOUNDARY
▲ TEMPORARY POND
▨ PERMANENT POND
➡ PERMANENT DIVERSION
•➡ TEMPORARY DIVERSION
001V NPDES PERMIT SEDIMENTATION POND

FIGURE 4-7a

SEDIMENTATION PONDS
West Area

SOURCE: TERA


001A
001B
001C
001D
001E
001G
001H
001I
001J
001F
001R
001S
001K
001O
001P
001T
001U
001Q
001N
001M
001L
N
0
1000
2000
METERS
0
2500
5000
FEET

LEGEND

— PERMIT AREA BOUNDARY

▲ TEMPORARY POND

▨ PERMANENT POND

➡ PERMANENT DIVERSION

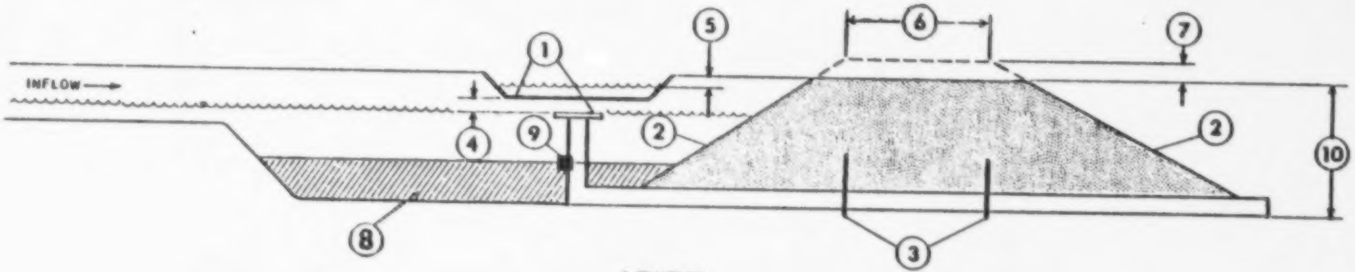
•→ TEMPORARY DIVERSION

001A NPDES PERMIT SEDIMENTATION POND

FIGURE 4-7b

SEDIMENTATION PONDS
East Area

SOURCE: TERA



LEGEND

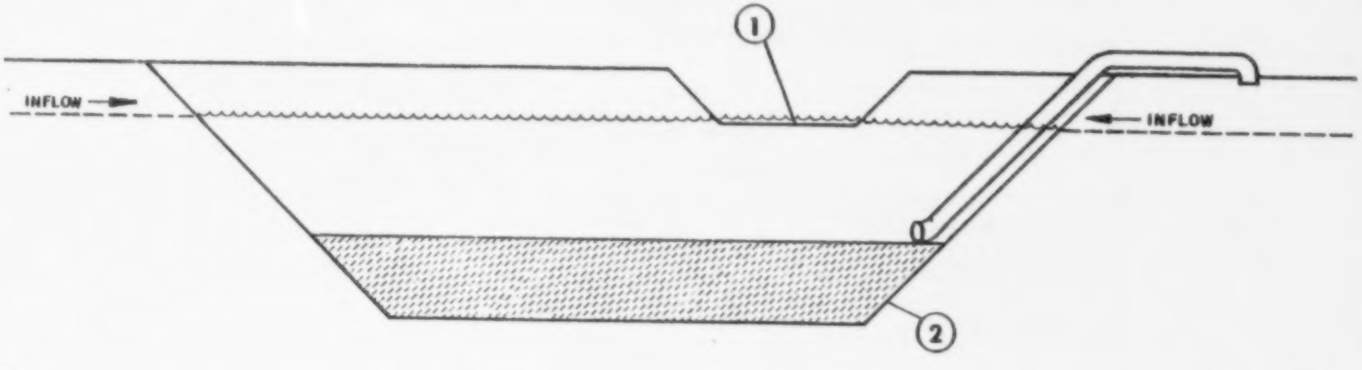
NUMBER	DESCRIPTION	< 20 FEET HEIGHT OR 20 ACRE-FEET	> 20 FEET HEIGHT OR 20 ACRE-FEET
①	COMBINED SPILLWAY CAPACITY	25 YEAR/24 HR. RUNOFF	100 YEAR/24 HR. RUNOFF
②	EMBANKMENT SLOPE	2:1 MAX., 5:1 MIN. COMBINED	2:1 MAX., 5:1 MIN. COMBINED 1.5 + FACTOR OF SAFETY
③	ANTI-SEEP DEVICE	NOT INSTALLED	INSTALLED
④	ELEVATION OF EMERGENCY SPILLWAY CREST ABOVE PRINCIPAL SPILLWAY	1.0 FOOT MINIMUM	
⑤	HEIGHT OF SETTLED EMBANKMENT ABOVE WATER SURFACE IN EMERGENCY SPILLWAY	1.0 FOOT MINIMUM	
⑥	TOP WIDTH OF EMBANKMENT (FEET)	(H + 35)/5	
⑦	ADDITIONAL CONSTRUCTED EMBANKMENT HEIGHT FOR SETTLEMENT (FEET)	.05 x H	
⑧	SEDIMENT STORAGE	0.1 ACRE-FOOT/ACRE DISTURBED LAND OR 3-YEAR ACCUMULATION	
⑨	DEWATERING DEVICE	MAINTAINED AT TOP OF SEDIMENT STORAGE ELEVATION	
⑩	DAM HEIGHT (H)	MEASURED FROM UPSTREAM TOE TO TOP OF EMBANKMENT	

TYPE 1 SEDIMENTATION POND DESIGN SPECIFICATIONS

FIGURE 4-8

TYPE I SEDIMENTATION POND

SOURCE: EPA, 1982



LEGEND

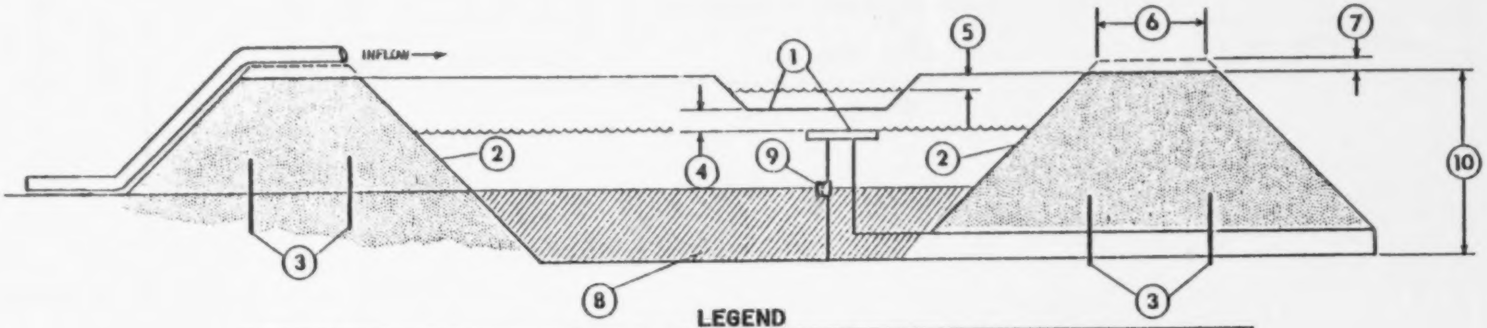
NUMBER	DESCRIPTION	< 20 ACRE FEET	> 20 ACRE FEET
①	OUTFLOW CAPACITY	TO PROVIDE DETAINMENT OF 10 YR 24 HR EVENT	
②	SEDIMENT STORAGE	0.1 ACRE-FOOT/ACRE DISTURBED LAND OR 3-YEAR ACCUMULATION	

TYPE 2 EXCAVATED SEDIMENTATION POND DESIGN SPECIFICATIONS

FIGURE 4-9

TYPE 2 SEDIMENTATION POND

SOURCE: EPA, 1982



LEGEND

NUMBER	DESCRIPTION	<20 FEET HEIGHT OR 20 ACRE-FEET	>20 FEET HEIGHT OR 20 ACRE-FEET
1	COMBINED SPILLWAY CAPACITY	10 YEAR/24 HR. EVENT	100 YEAR/24 HR. RUNOFF
2	EMBANKMENT SLOPE	2:1 MAX., 5:1 MIN. COMBINED	2:1 MAX., 5:1 MIN. COMBINED 1.5+ FACTOR OF SAFETY
3	ANTI-SEEP DEVICE	NOT INSTALLED	INSTALLED
4	ELEVATION OF EMERGENCY SPILLWAY CREST ABOVE PRINCIPAL SPILLWAY	1.0 FOOT MINIMUM	
5	HEIGHT OF SETTLED EMBANKMENT ABOVE WATER SURFACE IN EMERGENCY SPILLWAY	1.0 FOOT MINIMUM	
6	TOP WIDTH OF EMBANKMENT (FEET)	(H+35)/5	
7	ADDITIONAL CONSTRUCTED EMBANKMENT HEIGHT FOR SETTLEMENT (FEET)	.05 x H	
8	SEDIMENT STORAGE	0.1 ACRE-FOOT ACRE/DISTURBED LAND OR 3-YEAR ACCUMULATION	
9	DEWATERING DEVICE	MAINTAINED AT TOP OF SEDIMENT STORAGE ELEVATION	
10	DAM HEIGHT (H)	MEASURED FROM UPSTREAM TOE TO TOP OF EMBANKMENT	

TYPE 3 SEDIMENTATION POND DESIGN SPECIFICATIONS

FIGURE 4-10

TYPE 3 SEDIMENTATION POND

SOURCE : EPA, 1982

and 3 will be used in lowland areas. The drawings shown in Figures 4-8 through 4-10 are typical representative drawings only.

Runoff volume for each sedimentation pond was computed using Soil Conservation Service (SCS) procedures. Each sedimentation pond will be designed to have a detention capacity equal to the runoff volume (from the effective drainage area) resulting from a 10-year, 24-hour storm plus a required sediment storage capacity of 0.1 acre-foot for each acre of disturbed area. The total required runoff and sediment storage volume of each sedimentation pond will be contained at an elevation equal to or below the elevation of the overflow channel or principal spillway crest in accordance with LSMR regulations. Locations of the sedimentation ponds and required diversion channels for diverting overland flow into the ponds have been determined (Figure 4-7a and b). Each pond is numbered according to its location by state plane coordinates. Effective drainage and disturbed areas, estimated storm runoff and sediment storage volumes, and estimated total capacities for each pond are contained in Appendix B.

Ditches and Diversion Structures. As mining progresses, a series of ditches and diversion structures will be installed to control surface water runoff. These ditches will consist of two types: upstream interceptor ditches and sediment diversion ditches. Upstream interceptor ditches will be used to direct drainage from undisturbed areas away from disturbed areas to prevent co-mingling of drainage. Sediment diversion ditches will direct runoff from the disturbed areas to sediment control structures.

All ditches and diversion structures will be designed according to LSMR regulations depending upon the nature of the structure (temporary or permanent). Figure 4-11 depicts the characteristics of typical temporary and permanent diversion structure.

Runoff from undisturbed areas is not required to pass through a sedimentation pond. Therefore, to minimize the sizes of sedimentation ponds, much of the runoff from undisturbed areas will be diverted away from channels leading to the sedimentation ponds or will be detained in upstream reservoirs to be released after runoff from disturbed areas has passed through the sedimentation ponds. These reservoirs will be completed along with sedimentation ponds according to the schedule in Appendix B. These reservoirs are located upstream of the mine area (6647.17 and 6648.21; Appendix B) to detain runoff from the upper watershed of Tenmile Bayou. The reservoirs will be completed by the year 1995 to help minimize the size of sedimentation pond 6647.22 (Appendix B). Three other

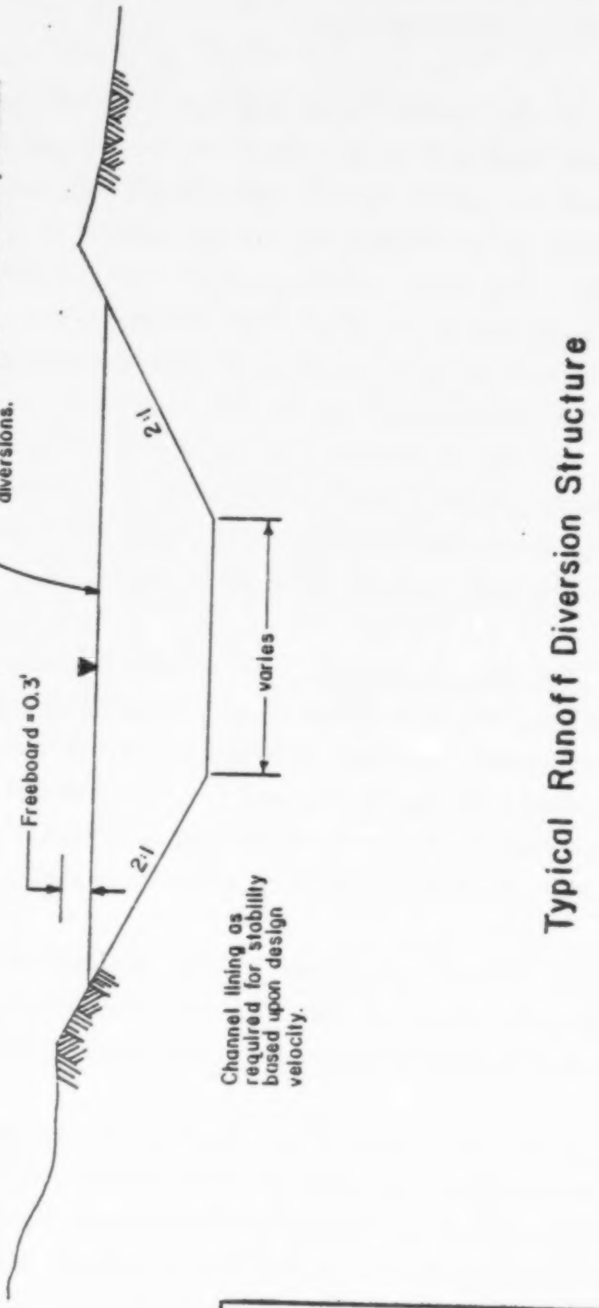

Water surface elevation resulting from 2 year recurrance interval precipitation event for temporary diversions, 10 year recurrance interval event for permanent diversions.
Freeboard = 0.3'
2:1
varies
2:1
Channel lining as required for stability based upon design velocity.
Typical Runoff Diversion Structure

FIGURE 4-11

TYPICAL RUNOFF DIVERSION STRUCTURE

SOURCE: EPA, 1982

ponds will also be constructed by the year 1997 upstream of sedimentation pond 6647.22, to be used as sedimentation ponds for runoff from disturbed areas as the mine progresses. Similar runoff control schemes are conceived for the other watersheds in the mine area. Additionally, storage capacities of several existing ponds in the project area may be used to minimize runoff to sedimentation ponds.

Diversion and Rerouting of Streams. To control drainage from upstream areas, it will be necessary to construct several stream channel diversions as shown on Figure 4-7a and b (Section 4.4.4.6). It is anticipated that these diversions will be both temporary and permanent in nature and will be designed to prevent contribution of sediment to streamflow or runoff from outside the permit area. Temporary diversions will be designed so that the channel, bank, and adjacent floodplain will safely pass the peak runoff from a 10-year, 24-hour precipitation event. Permanent diversions are required to enable mining through or near the existing channels and to prevent flood flows from interfering with mining operations. Permanent diversions will be designed for runoff from 100-year 24-hour event. The capacity of the channel itself will be designed to equal the capacity of the unmodified stream channel immediately upstream and downstream of the diversion itself. Temporary diversions will be as follows: Chatman Bayou, 2,591 meters (8,500 feet) and 2,134 meters (7,000 feet); West Branch Dolet Bayou, 2,286 meters (7,500 feet) and 610 meters (2,000 feet); Prairie Bayou, 3,658 meters (12,000 feet) and 1,676 meters (5,500 feet); and Louies Bayou, 1,829 meters (6,000 feet) and 1,219 meters (4,000 feet). Permanent diversions will be as follows: Chatman Bayou, 3,353 meters (11,000 feet); Tenmile Bayou, 2,438 meters (8,000 feet); Louies Bayou, 2,667 meters (8,750 feet); and Prairie Bayou, 2,286 meters (7,500 feet) (see Section 5.8.1.3 for stream locations).

When no longer needed, temporary diversions will be removed, and the stream will be returned to a configuration that approximates premining stream channel characteristics. Permanent relocations will approximate the original length, slope, and other morphological characteristics, but location will be a displacement in position as a result of mining requirements. Figures 4-12 and 4-13 show the pertinent design characteristics of a temporary and permanent stream channel diversion, respectively.

Flood Prevention Levees. Levees will be necessary to prevent flooding caused by backwater when mining near the Buffalo, Mundy, and San Patricio bayous in the west area and near West Branch, Dolet, Prairie, and Louies bayous in the east area, as well as other

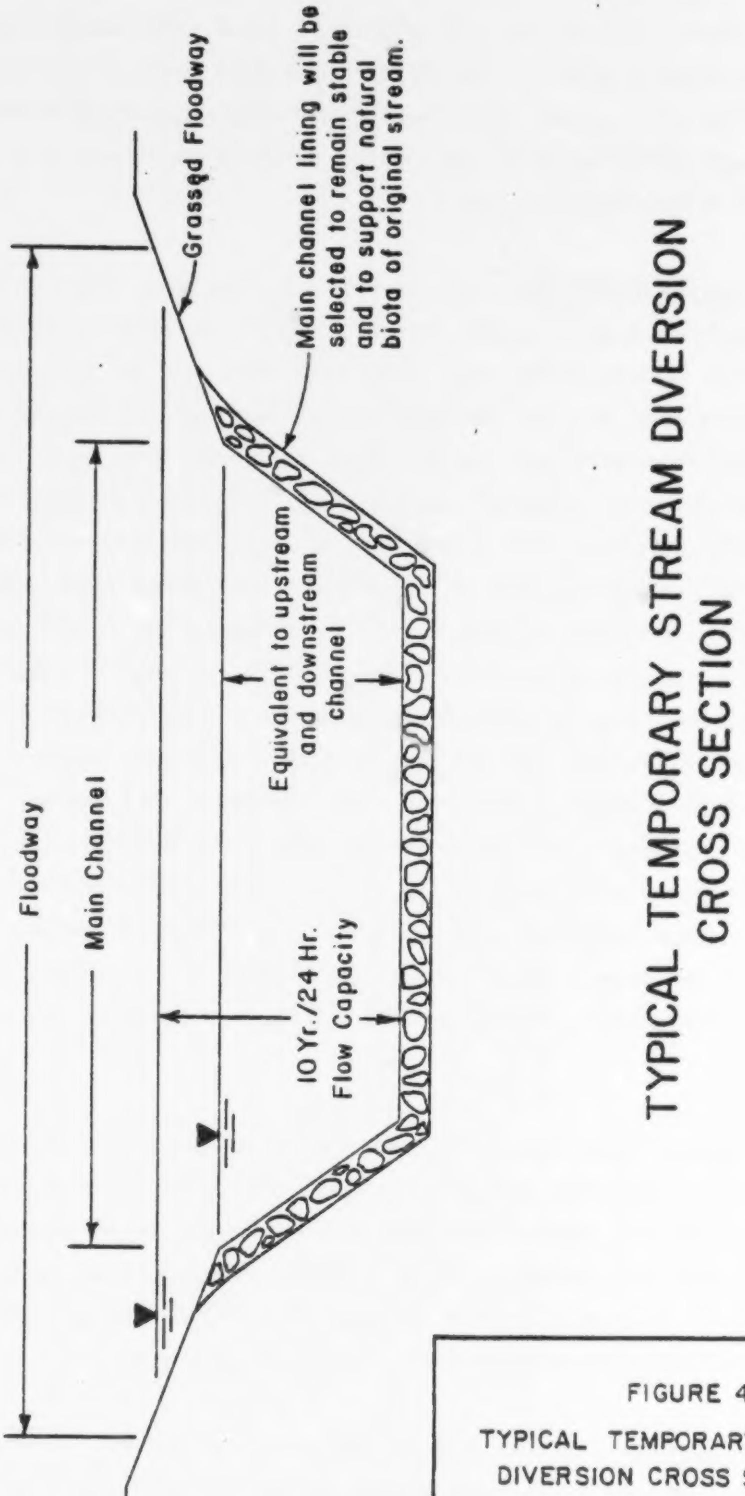
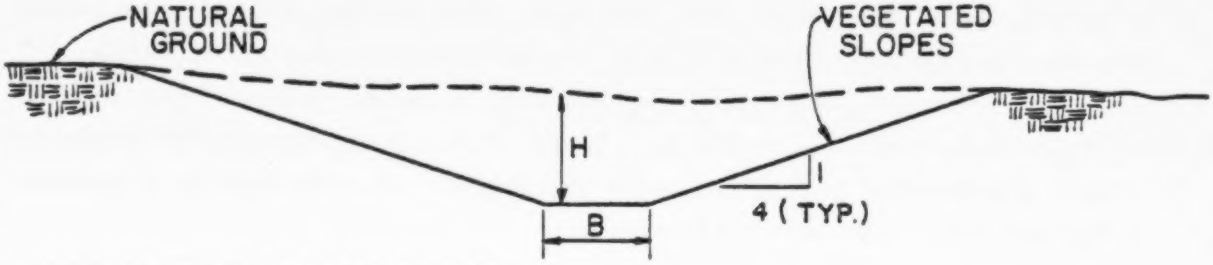

Grassed Floodway
Main channel lining will be selected to remain stable and to support natural biota of original stream.
Floodway
Main Channel
Equivalent to upstream and downstream channel
10 Yr./24 Hr. Flow Capacity
TYPICAL TEMPORARY STREAM DIVERSION CROSS SECTION

FIGURE 4-12

TYPICAL TEMPORARY STREAM DIVERSION CROSS SECTION

SOURCE: EPA, 1982


NATURAL GROUND
VEGETATED SLOPES
H
B
1
4 (TYP.)

BOTTOM WIDTH (B) AND DEPTH OF CUT (H) VARY WITH EACH DIVERSION.

NO SCALE

FIGURE 4-13

TYPICAL PERMANENT DIVERSION

SOURCE TERA

streams in the project area. These levees will be designed for a flood resulting from a 100-year, 24-hour storm. In some cases, the levee will also be used as a haul road embankment and/or a pond embankment. Where a levee is used for a sedimentation pond embankment, the emergency spillway for the sedimentation pond will consist of culverts with flap gates to prevent flooding by backwater during high stage conditions.

Control of Overland Flow. Overland flow must be controlled during mining operations to prevent runoff from entering active mine pits. As mining progresses, runoff toward the mine pit will be diverted around the pit or, in cases where diversion channel excavations would be too great, catchment basins will be formed by temporary dikes to keep water out of the pit. Runoff water in the catchment basins will be pumped to a channel to convey the water downstream of the pit. Other overland flow diversions will be necessary to direct runoff from disturbed areas toward sedimentation ponds. Temporary overland flow diversion channels will be designed for a 2-year storm, as required by LSMR regulation 216.43. Overland flow is not anticipated to be problematic since the majority of mining is in the head waters of the affected bayous.

4.4.4.7 Dewatering

The surface mining in the Dolet Hills project will provide lignite from seams approximately 1.8 meters (6 feet) thick located at depths typically ranging from 24 to 27.4 meters (80 to 90 feet) below the surface near pump tests performed in the west area to seams typically 1.8 to 2.4 meters (6 to 8 feet) thick at depths of 35 meters (115 feet) and deeper near the east area pump tests (EH&A, 1980 and Paul Wier, 1980). Actual depths of overburden vary across the permit area from none in lignite outcrops to nearly 61 meters (200 feet) deep. The piezometric levels of ground water at these same pump test locations range from near-surface to 6 meters (20 feet) deep in the western area and to nearly 35 meters (115 feet) deep in the eastern area (EH&A, 1980).

As a result of the large variation in ground-water levels and depths of excavation required to obtain the lignite, the extent of dewatering activities will be time dependent as a function of the location of the open pit. In general, when the excavations occur to depths below the ground-water potentiometric levels, movement of the ground water in the vicinity of the mine excavation can be expected to be toward the excavation and its associated dewatering and/or depressurization system. For any given excavation, the volume of ground water involved and the general area influenced in dewatering of the excavation will depend upon the following variables:

(1) depth of active cut;
(2) duration of cut;
(3) position of potentiometric surface(s);
(4) exposed aquifer thickness;
(5) aquifer permeability;
(6) aquifer storage coefficient; and
(7) methods of dewatering.

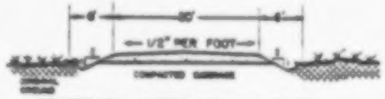
The specific yield of ground water in the project area is generally expected to be small enough to allow dewatering with sump pumps in the excavations. Well points and advance dewatering will be limited to those locations of higher specific yield and where depressurization is required.

4.4.4.8 Road Construction and Maintenance

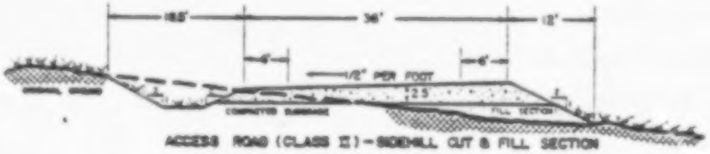
Three major types of roads are to be constructed in the mine area: lignite haul roads, access roads, and temporary access roads. Roads will be constructed in accordance with sound engineering and regulatory standards, according to the size, type, and density of scheduled vehicular traffic. Representative cross sections of these three types of roads are presented in Figure 4-14. The road surfaces will be maintained, as needed, on a regular basis by grading, ditch cleaning, and adding additional surfacing material. A water truck will be used, as needed, to control fugitive dust. When roads are no longer needed, surfacing material and culverts will be salvaged, whenever possible, and the surface will be regraded and reclaimed to an approved postmining land use compatible with the surrounding area.

Stream crossings by roads within the permit area will be designed in compliance with LSMR 216.153, 216.163 and 216.172. These rules specify the requirements for roads according to Classes I, II, and III. Culverts and bridges for Class I roads (lignite haul roads) will meet the following minimum requirements:

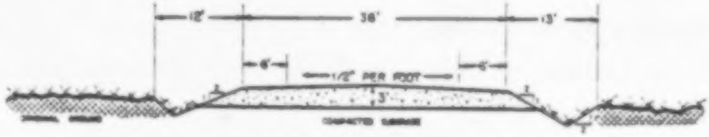
o Culverts with an end area of 3.25 square meters (35 square feet) or less and bridges with spans of 9.1 meters (30 feet) or less will be designed to safely pass the 10-year,


6'
20'
6'
1/2" PER FOOT
ORIGINAL GROUND
COMPACTED SUBGRADE

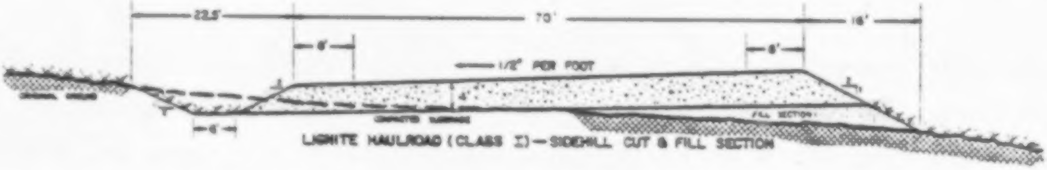
TEMPORARY ACCESS ROAD (CLASS III)


18.5'
36'
12'
6'
6'
1/2" PER FOOT
2.5'
ORIGINAL GROUND
COMPACTED SUBGRADE
FILL SECTION

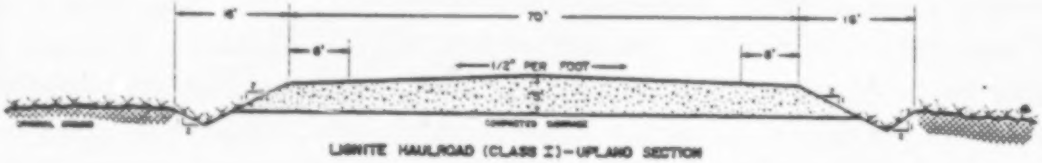
ACCESS ROAD (CLASS II)—SIDEHILL CUT & FILL SECTION


12'
36'
13'
6'
6'
1/2" PER FOOT
3'
ORIGINAL GROUND
COMPACTED SUBGRADE

ACCESS ROAD (CLASS II)—UPLAND SECTION


22.5'
70'
16'
8'
8'
1/2" PER FOOT
4'
6'
ORIGINAL GROUND
COMPACTED SUBGRADE
FILL SECTION

LIGNITE HAULROAD (CLASS I)—SIDEHILL CUT & FILL SECTION


16'
70'
16'
8'
8'
1/2" PER FOOT
ORIGINAL GROUND
COMPACTED SUBGRADE

LIGNITE HAULROAD (CLASS I)—UPLAND SECTION

NOTE: DEPTH OF SURFACING MATERIAL AND CUT AND FILL SLOPES WILL VARY DEPENDING ON THE STRENGTH OF NATIVE SOIL MATERIALS. DITCH DIMENSIONS AND LINING MATERIALS WILL VARY DEPENDING ON LOCAL HYDROLOGIC PARAMETERS

FIGURE 4-14

TYPICAL HAUL ROAD CROSS SECTIONS

SOURCE: EPA, 1982

24-hour precipitation event without a head of water at the entrance. Culverts with an end area of greater than 3.25 square meters (35 square feet) will be designed to safely pass the 20-year, 24-hour precipitation event. Bridges with spans of more than 9.1 meters (30 feet) will be designed to safely pass the 100-year, 24-hour precipitation event or a larger event as specified by LSMR 216.153.

- Drainage pipes and culverts will be constructed to avoid plugging or collapse and erosion at inlets and outlets.
- All culverts will be covered by compacted fill to a minimum depth of 30.5 centimeters (1 foot).
- Culverts will be designed, constructed, and maintained to sustain the vertical soil pressure, the passive resistance of the foundation, and the weight of vehicles to be used.

Culverts and bridges for Class II roads (access roads) will meet the following requirements:

- Culverts with an end area of 3.25 square meters (35 square feet) or less will be designed to safely pass the 10-year, 24-hour precipitation event without a head of water at the entrance. Culverts with an end area of greater than 3.25 square meters (35 square feet) and bridges with spans of 9.1 meters (30 feet) or less, will be designed to safely pass the 20-year, 24-hour precipitation event. Bridges with spans of more than 9.1 meters (30 feet) will be designed to safely pass the 100-year, 24-hour precipitation event or larger event as specified by LSMR 216.163.
- Drainage pipes and culverts will be constructed to avoid plugging or collapse and erosion at inlets and outlets.
- Culverts will be covered by compacted fill to a minimum depth of 30.5 centimeters (1 foot).
- Culverts will be designed, constructed, and maintained to sustain the vertical soil pressure, the passive resistance of the road foundation, and the weight of vehicles to be used.

For Class III roads (temporary access roads) temporary culverts will be installed for all flowing drainages and stream crossings. Temporary culverts and bridges will be sized to safely pass the 1-year, 6-hour precipitation event.

Figure 4-15 is a cross section and end view of a typical stream crossing showing the pertinent design characteristics.

4.4.5 Reclamation and Revegetation

4.4.5.1 General Reclamation Procedure

Reclamation activities will be conducted immediately following each complete mining operation. The intended postmining land uses for the permit area include commercial pine forest, pasture land, fish and wildlife habitat, and developed water resources. Most of the area is currently forest, and many landowners contacted by CLECO/SWEPCO in the area prefer forest as a postmining land use (Camp, 1982). In order to determine the feasibility of reclaiming the majority of the mined area to pine forest, the Dolet Hills Lignite Mine Project initiated a series of reclamation field studies in 1980. The purpose of these studies was to ascertain the revegetation potential of various geologic materials when compared to native soils. The three materials tested were: unoxidized overburden; oxidized overburden; and mixed overburden. A suitable study site was selected in the northeastern part of the permit area based on representatative overburden characteristics. The revegetation objectives tested were:

1. The establishment of a suitable herbaceous vegetation to control erosion, and;
2. The establishment of commercial pine trees.

A test pit was excavated in November of 1979 to a depth of 13.7 meters (45 feet). The oxidized overburden material, (0-4.5 meters (15 feet in depth) was segregated and stockpiled. The unoxidized overburden was excavated from 4.5 meters (15 feet) down to 13.7 meters (45 feet). A third study material was an equal mixture of unoxidized and oxidized zone materials. The three overburden materials were backfilled into excavated test pit cells. Each of the overburden test pit cells was replicated three times. In March of 1981, three separate plots were established on the native soil adjacent to the test pit area as control plots. Following backfilling, the treatments were seeded to annual ryegrass and in February of 1980 pine seedlings were planted directly in the ryegrass. The summer of 1980 was extremely dry and the prolonged drought resulted in only 10 percent survival of the pine seedlings. Common bermudagrass and subterranean clover were tested as understory vegetation rather than using ryegrass to control erosion between the pine trees. In 1981 the plots were replanted with loblolly pine seedlings and fertilized at a

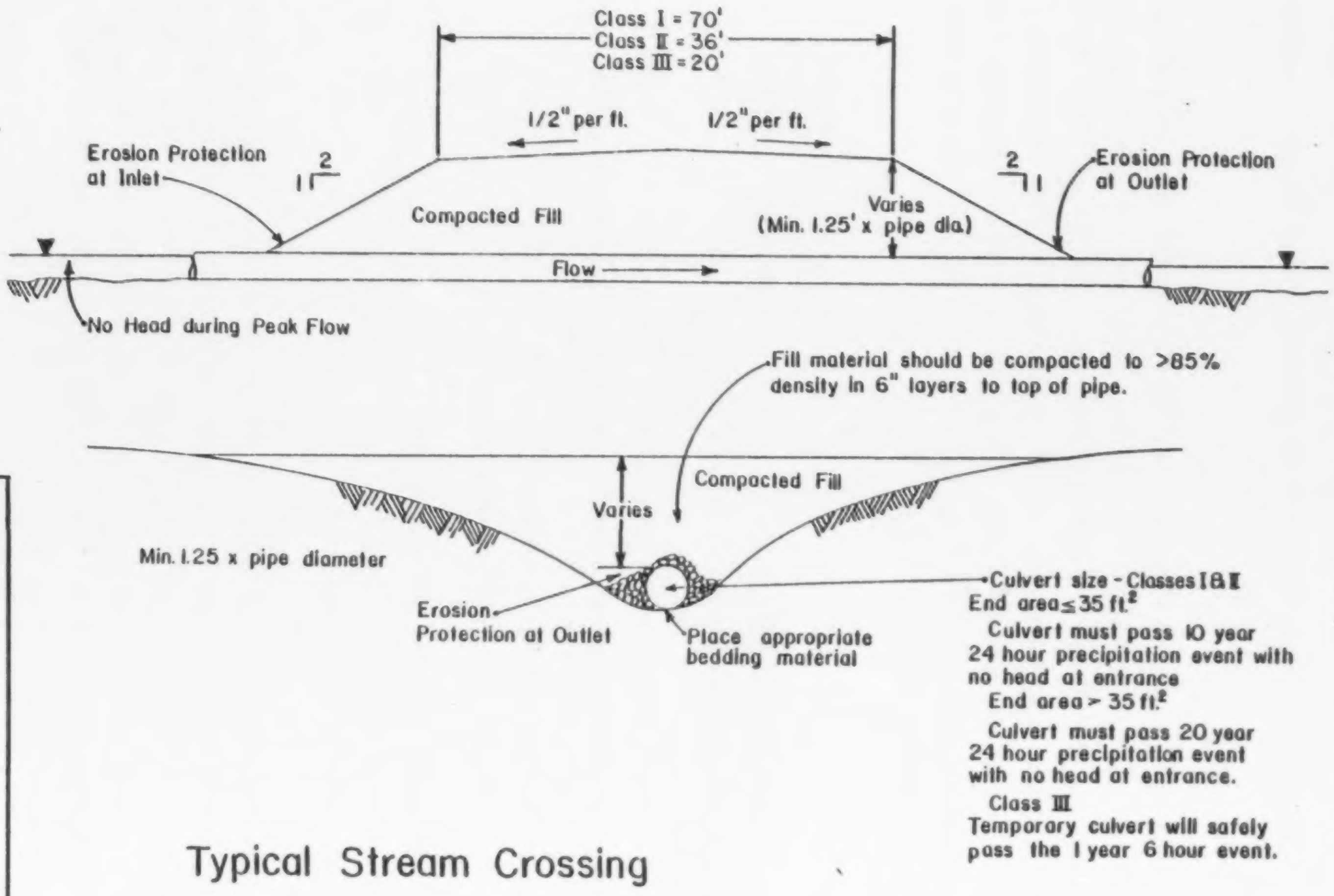

Class I = 70'
Class II = 36'
Class III = 20'
1/2" per ft.
1/2" per ft.
Erosion Protection at Inlet
2
1
Compacted Fill
Varies (Min. 1.25' x pipe dia.)
2
1
Erosion Protection at Outlet
Flow
No Head during Peak Flow
Fill material should be compacted to >85% density in 6" layers to top of pipe.
Compacted Fill
Varies
Min. 1.25 x pipe diameter
Erosion Protection at Outlet
Place appropriate bedding material
Culvert size - Classes I & II
End area ≤ 35 ft.²
Culvert must pass 10 year 24 hour precipitation event with no head at entrance
End area > 35 ft.²
Culvert must pass 20 year 24 hour precipitation event with no head at entrance.
Class III
Temporary culvert will safely pass the 1 year 6 hour event.
Typical Stream Crossing

FIGURE 4-15

TYPICAL STREAM CROSSING

SOURCE : EPA , 1982

rate of 113.5 kilograms per hectare (100 pounds per acre) of nitrogen, phosphorus, and potassium.

The statistical analysis of the pine tree survival data showed that the soil control with clover, soil control with grass, and the oxidized overburden with clover are not significantly different at the .05 level of confidence (Harbert and Draves, 1982). Following the 1981 growing season, pine tree height and diameter measurements were taken at the test pit site. The statistical analysis showed that at the .05 level of confidence there was no significant different between the soil control with either grass or clover and the oxidized material with clover (Harbert and Draves, 1982).

Overburden Materials	Survival (percent)	Height Growth (inches)	Diameter Growth (inches)
1. Unoxidized overburden with bermudagrass understory	47	1.5	.07
2. Unoxidized overburden with clover understory	67	1.8	.07
3. Mixed overburden with bermudagrass understory	46	1.8	.08
4. Mixed overburden with clover understory	63	2.2	.08
5. Oxidized overburden with bermudagrass understory	75	4.9	.15
6. Oxidized overburden with clover understory	74	8.3	.25
7. Soil control bermudagrass understory	63	8.7	.11
8. Soil control clover understory	57	9.1	.13

To date, pine trees have been successfully grown on the oxidized material at a level equal to or better than pine trees growing on the native soils. In addition, the overburden chemistry from the sandy regions of the project in the east area shows that the sandy material is a suitable plant growth media which is equal to the native soils on the project area with regard to physical and chemical characteristics (see Section 5.1.3.1 for an assessment of overburden in the Dolet Hills permit area).

Field test studies are currently being planned to evaluate this sandy material. Initial pine seedling plantings will occur in early 1983. These studies are being coordinated with LOCSMD and SCS.

Where pastureland or forest is not required by lease agreement as a postmining land use, reclamation procedures generally will be designed to achieve a postmining land use that is comparable to premining conditions. Wildlife habitat areas will be created around postmining ponds, diversions, and throughout forests that are not required by lease to be commercial pine forests. Undisturbed lands within the permit area will remain in their premining land use.

4.4.5.2 Revegetation

Vegetation species will be planted at the first appropriate season for the species selected. Vegetation species to be planted have been selected based primarily on the intended postmining land use and species suitability for the project area. Other factors that will determine which species are proposed for the planting in specific areas include postmining soil characteristics and topography. Areas within the permit boundary that will be reclaimed to other than commercial forest (by lease agreements) will have 0.4-hectare (1-acre) portions for every 8-10 hectares (20-25 acres) interspersed with species suitable for fish and wildlife habitat. Table 4-4 lists species to be used for revegetation in the various habitats.

4.5 ALTERNATIVES AVAILABLE TO EPA

Three alternatives are available to EPA regarding its permit action. These are: (1) issue the NPDES permit as proposed; (2) issue the NPDES permit with certain conditions; or (3) deny the NPDES permit. The issuance of the NPDES permit as proposed would allow DHMV to construct and operate the surface lignite mine as described in Section 4.4 and to discharge wastewater to the limits set forth in the permit. However, EPA may determine that special conditions should be added to the NPDES permit where necessary to minimize or avoid adverse environmental impacts. EPA may deny the NPDES permit if certain environmental considerations are significantly adversely impacted and mitigation measures are unacceptable. These considerations include violations of water quality standards, significant impacts on the human environment, endangered species, cultural resources, wetlands, floodplains and prime farmlands. Denial of the NPDES permit by EPA could cause DHMV to redesign the project for no effluent discharge or pursue the no action alternative.

TABLE 4-4

REPRESENTATIVE VEGETATION SPECIES TO BE USED IN THE DOLET HILLS LIGNITE MINE RECLAMATION PLAN

Species	Planting Dates	Spacing (ft)	Trees/Acre
Tree Species for Commercial Forestry:			
Loblolly pine (Pinus taeda)	Dec - Mar	8 x 8	650
Green ash (Fraxinus pennsylvanica)	Dec - Mar	10 x 10	10
Cherrybark oak (Quercus falcata var. pagodaefolia)	Dec - Mar	10 x 10	10
Hickory (Carya spp.)	Dec - Mar	10 x 10	10
Water oak (Quercus nigra)	Dec - Mar	10 x 10	10
Southern red oak (Quercus falcata)	Dec - Mar	10 x 10	10
Sweetgum (Liquidambar styraciflua)	Dec - Mar	10 x 10	10
Cottonwood (Populus deltoides)	Dec - Mar	10 x 10	10
Woody Species Mixture for Forest Areas:			
Arrowwood (Viburnum dentatum)	Dec - Mar	5 x 5	75
Blue haw (Crataegus brachyacantha)	Dec - Mar	10 x 10	50
Amur honeysuckle (Lonicera maackii)	Dec - Mar	8 x 8	150
Black cherry (Prunus serotina)	Dec - Mar	10 x 10	50
Sawtooth oak (Quercus acutissima)	Dec - Mar	12 x 12	75
Blackgum (Nyssa sylvatica)	Dec - Mar	10 x 10	50
Flowering dogwood (Cornus florida)	Dec - Mar	10 x 10	75
Holly (Ilex spp.)	Dec - Mar	1 x 3	30
Greenbriar (Smilax spp.)	Dec - Mar	1 x 3	30
Wild grapes (Vitis spp.)	Dec - Mar	1 x 3	30

TABLE 4-4 (Cont'd)

Species	Planting Dates	Seeding Rate (lbs/ac)
Temporary and Permanent Herbaceous Species for Pastureland:		
Common bermudagrass (*Cynodon dactylon*)	Apr - Jun	10
Crimson clover (*Trifolium incarnatum*)	Aug - Dec	15
Bahiagrass (*Paspalum notatum*)	Sep - Jul	20
Annual ryegrass (*Lolium multiflorum*)	Sep - Apr	40
Winter wheat (*Triticum vulgare*)	Aug - Oct	40
Switch grass (*Panicum virgatum*)	Mar - Jun	5
Subterranean clover (*Trifolium subterraneum*)	Aug - Nov	20
Reed canarygrass (*Phalaris arundinacea*)	Apr - Jul	5
Yuchi arrow leaf clover (*Trifolium* sp.)	Aug - Dec	15
Carpetgrass (*Axonopus affinis*)	Sep - Mar	15
Lespedeza (*Lespedeza* spp.)	Jan - Mar	40
Coastal bermudagrass (*Cynodon dactylon*)	Mar - Jun	35 (bu/ac)
Sorghum - sudan grass hybrids (*Sorghum* spp.)	Apr - Jul	20
White clover (*Trifolium repens*)	Aug - Dec	5
Millet (*Setaria* sp.)	Mar - Jul	15

TABLE 4-4 (Concluded)

Species	Planting Dates	Spacing (ft)	Trees/Acre
Woody Species for Fish and Wildlife Habitat			
Blackberry (*Rubus* sp.)	Dec - Mar	8 x 8	150
Wax myrtle (*Myrica cerifera*)	Dec - Mar	8 x 8	20
Fringe tree (*Chionanthus virginica*)	Dec - Mar	10 x 10	20
Flowering dogwood	Dec - Mar	8 x 8	75
Holly	Dec - Mar	1 x 3	30
Greenbriar	Dec - Mar	1 x 3	30
Wild grapes	Dec - Mar	1 x 3	30
Tree Species for Fish and Wildlife Habitat Subject to Occasional Flooding:			
Green ash	Dec - Mar	10 x 10	75
Water oak	Dec - Mar	10 x 10	75
Nuttall oak (*Quercus nuttallii*)	Dec - Mar	10 x 10	75
Shumard oak (*Quercus shumardii*)	Dec - Mar	10 x 10	75
Bald cypress (*Taxodium distichum*)	Dec - Mar	10 x 10	75
Cottonwood	Dec - Mar	10 x 10	75

4.6 ALTERNATIVES AVAILABLE TO OTHER PERMITTING AGENCIES

4.6.1 U.S. Army Corps of Engineers

The USCE regulates the discharge of dredged and fill material into waters of the United States including wetlands under Section 404 of the Clean Water Act. In addition, it regulates any work or structures in or affecting a navigable water of the United States as defined in the River and Harbor Act of 1899. The New Orleans and Fort Worth Districts of the USCE are jointly responsible for reviewing the project for compliance with Sections 404/10. Each USCE District will evaluate the individual 5-year mine blocks located within its boundary. If an individual permit is required by the USCE for the work, a 20-25 day public comment period is required. During this time, the application is reviewed by adjacent landowners, various State and Federal agencies, private organizations and other interested individuals. A thorough review of the project and comments received precedes a decision on the permit application. The USCE decision would be one of the following:

1. issuance of the permit,
2. issuance of the permit with special conditions or modifications, or
3. denial of the permit

4.6.2 Louisiana Office of Conservation, Surface Mining Division

Louisiana has had their state regulatory program for mining approved by the Office of Surface Mining. The program is administered by the Louisiana Office of Conservation, Surface Mining Division (LOCSMD). The applicant must receive a permit from this office, which may 1) issue the permit for the project as proposed, 2) issue the permit with conditions or modifications to the project, or 3) deny the permit for the project.

4.7 OTHER REASONABLE ALTERNATIVES

No other reasonable alternatives, outside the jurisdiction of the lead agency or any cooperating agency, have been identified.

5.0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

This section presents an assessment of potential impacts associated with the Dolet Hills Lignite Mine Project. For purposes of discussion, the 11,968 hectares (29,573 acres) that will encompass the mining blocks; the ancillary facilities such as the main office, field offices, haul roads, etc.; and any associated ancillary activity hectarage that may potentially be affected during the life of the mine is defined as the permit area. Construction impacts are those associated with clearing, levelling, and building of ancillary facilities necessary for mine operation. Clearing, mining, and reclamation activities of the mining blocks are assessed as operations impacts.

5.1 EARTH RESOURCES

5.1.1 Topography

5.1.1.1 Existing Environment

The Dolet Hills permit area is situated within the West Coastal Plain physiographic province. Three major land forms are notable within the area: low-lying alluvial valleys, alluvial terraces, and rolling uplands. Land elevations within the permit area range from a low of approximately 36.5 meters (120 feet) above mean sea level (msl) occurring along the floodplain of Dead Negro Branch in the southeastern portion of the permit area, to a high near 118.8 meters (390 feet) msl occurring in the uplands of the central portion of the permit area (see Figures 5-3a and b in Section 5.2.2.1 for topographic relief).

5.1.1.2 Effects of No Action

The no action alternative would eliminate the adverse impacts of construction and operation related to the Dolet Hills Lignite Mine Project. Gravel is being mined in the permit area and lignite development is occurring in the vicinity of the project. Further development within the proposed permit area could adversely impact topography.

5.1.1.3 Construction Impacts

Construction activities will involve the surface or near-surface disturbance by grading of approximately 253 hectares (625 acres) of land for mine facilities, dragline erection pads, haul roads, conveyor system, permanent sedimentation ponds and stream diversions (outside of mining blocks). Some alterations to local topography will result; however, adverse impacts will be minimal.

5.1.1.4 Operation Impacts

Topography will experience local, short-term adverse impacts resulting from mining. It is expected that one to two years will be necessary to reclaim mined areas, and reclamation activities will be conducted concurrently with mining. The reclamation practices will involve reshaping the mined surface to a configuration similar to premining topography and the removal of temporary sedimentation ponds constructed on graded surfaces after they are no longer required.

Overburden that is removed and then replaced during the mining process, commonly undergoes an initial bulking, or volumetric increase (swell factor), immediately followed by redensification and settlement. The total increase or decrease in volume is dependent upon time; thickness of overburden being mined; and relative sand, silt, and clay percentage. It is expected that an approximate 5- to 10- percent net volume increase will occur in the replaced overburden after the initial swelling and compaction is completed. With the removal of the lignite, the resulting change in the ground surface elevation over the mined area will be minimal, therefore adverse impacts resulting from mining will be minor.

Studies in Texas (Schneider, 1977) have shown that approximately 75 percent of all expected subsidence will occur during the first year after the final grading of mine spoil, and that 80 percent will occur within the first five years after final grading is accomplished. Additional differential subsidence within localized fields may occur for a period of two to six years following final grading. This may cause micro-relief of highs and lows that, if not modified, could cause localized drainage problems. For woodland and pasture uses, little effect would be noted; for intensive row crops production, land-leveling might be desirable. The effects of subsidence are short-term; however, if deemed necessary by LOCSMD for bond release, DHMV would reverse or correct subsidence impacts through land-leveling activities within 5 years of reclamation.

5.1.1.5 Combined Impacts of Power Plant and Mine

Construction operations involving the power plant facilities, mine ancillary facilities, haul roads, etc. will result in adverse impacts to the topography. Plant site topography will be altered by disposal of fly ash/scrubber sludge, and alterations of topography will result from mining operations. The mined surface, however, will be reshaped by reclamation activities to a configuration similar to the premining topography resulting in minimal long-term adverse impacts.

5.1.2 Geology

5.1.2.1 Existing Environment

A description of the regional geology and geologic structure is presented in the Dolet Hills Power Plant Draft EIS (EPA, 1981) and in baseline studies conducted for the proposed project (EH&A, 1980a). Figures 4-2 through 4-5 (pages 4-5, 4-6, 4-8, and 4-9) of the Dolet Hills Power Plant Draft EIS (EPA, 1981) show geologic structure, stratigraphy, and surficial geology that encompasses the proposed mine permit area.

The Dolet Hills permit area is located within an area of seismic risk labeled as zone I (U.S. Dept. of Commerce, 1970). This zone is characterized as an area where there exists a possibility of minor damage resulting from the occurrence of earthquakes. Historically, a series of moderate earthquakes centered in the Texas-Louisiana border area approximately 24 kilometers (15 miles) west-southwest of Mansfield occurred beginning on April 23, 1964. Intensities of the shocks were five or less on the modified Mercali scale. This scale measures the effects on people, man-made objects, and the earth's surface. The strongest earthquake recorded in the region occurred on 8 January 1891 and had an intensity of seven. The epicenter of this quake was in the vicinity of Rusk, Texas (Von Hake, 1977).

The near-surface geologic formations existing in the permit area and vicinity are Lower Tertiary and Quaternary in age and are, in descending stratigraphic order: Quaternary alluvium and terrace deposits; the Cow Bayou, Dolet Hills, and Naborton formations of the Wilcox Group; and the Porters Creek Formation of the Midway Group.

The Porters Creek Formation is the uppermost unit of the Midway Group and is overlain conformably by the Naborton Formation of the Wilcox Group. Within the permit area, the top of the Porters Creek Formation lies at a depth ranging from approximately 76.2 to 213.4 meters (250 to 700 feet) below ground surface. The formation has a thickness ranging from 152 to 182.5 meters (500 to 600 feet) and consists of black lignitic and limey shales and clays deposited in a marine or coastal environment. There is a gradational change from the silty clays of the Porters Creek Formation to the sands and silts of the overlying Naborton Formation. The formational contact between these units is generally selected at the base of the last dominantly sandy stratum of the Naborton Formation (Murray, 1948). The Porters Creek Formation outcrops approximately 81.5 kilometers (50 miles) northwest of the permit area.

Sediments of the lignite-bearing Wilcox Group consist of recurrent alternating beds of sand, lignitic shale, and calcareous silts and clays that are locally glauconitic. Each recurrent pattern of sedimentary units represents a cyclic depositional package deposited by one retreat and one advance of the waters of the Gulf of Mexico during the Tertiary Period. Each complete cyclic sequence is generally designated as a formation.

The Naborton Formation consists of calcareous, buff- to gray-colored, fine- to medium-grained sands, silts, and clays ranging in thickness from 45.6 to 60.8 meters (150 to 200 feet). It outcrops in the northeastern portion of the permit area. The contact between the Naborton and the overlying Dolet Hills Formation is marked by the Chemard Lake Lentil of the Naborton, a 3-meter (10-feet) thick unit that contains the major mineable lignite seam. The Dolet Hills Formation consists of fine- to medium-grained sands containing lenses of silt and clay, and thin seams of lignite. The formation outcrops south of the outcrop of the Naborton Formation and covers approximately 40 percent of the permit area. The sediments of the Cow Bayou Formation are transitional from the underlying sediments of the Dolet Hills Formation and consist of brown lignitic silts and clays, with interbedded gray to brown silts, clays, and fine-grained sands. The Cow Bayou Formation outcrops in the southwestern portion of the permit area.

Unconformably overlying the Tertiary sediments within the permit area are thin alluvial and terrace deposits of Quaternary Age. This material consists predominantly of loosely packed sands, silts, and clays deposited by the ancient and modern Sabine River and Red River fluvial systems.

There exists the possibility of important paleontological resources (i.e., vertebrate fossils) in the Wilcox formations to be mined; however there are no known unique fossil recoveries in the region. Most fossils found in the Naborton or Dolet Hills are only of local importance, serving as marker beds for formation changes, and are not necessarily unique in nature.

Oil and gas are the major mineral commodities being obtained from the region, and there are several producing fields within or immediately adjacent to the permit area. A recent inventory of Louisiana Department of Conservation records indicated that there are approximately 60 producing oil and gas wells within the permit area, and there are also several abandoned wells and pipelines within the area. Production has declined over the past 20 years, and current rates are an average 10 barrels per day per well (Porter, 1980).

Lignite is present throughout northern Louisiana in recoverable quantities. A recent study by Roland, et al. (1976), the first comprehensive report concerning lignite reserves in Louisiana, conservatively estimates the extent and volume of lignite reserves in De Soto Parish at 546 million tons. There is no commercial lignite production taking place at this time, however, in the vicinity.

There are presently two sources of gravel in the vicinity of the proposed project. Silica gravel composed of quartz, chert, and other silicate minerals is being mined from isolated sites within the alluvium and terrace deposits along the Red River. Ironstone gravel, principally hematite, has been mined within the permit area for use as road base material.

5.1.2.2 Effects of No Action

The no action alternative would eliminate the adverse impacts of mining operations related to the Dolet Hills Lignite Mine Project. Mining of iron-ore gravel in the permit area will continue to adversely impact geologic resources. Future lignite development would have an adverse and irretrievable effect on that natural resource.

5.1.2.3 Construction Impacts

Construction activities in the mine area will be limited principally to the construction of shop facilities, dragline erection pads, haul roads, conveyor systems, permanent sedimentation ponds, and stream diversions (outside of mining blocks). The area that will be disturbed by these activities will be about 253 hectares (625 acres), compared to the 6,259 hectares (15,466 acres) proposed for mining. The majority of the construction activities will be confined to the ancillary facilities area of the mine. Impacts to geology are considered to be minor, and will consist of the displacement or destruction of surface and shallow subsurface geological features.

5.1.2.4 Operation Impacts

The total area to be affected by mining is estimated at 6,259 hectares (15,466 acres) with an average of 195 hectares (483 acres) to be mined on an annual basis over the life of the mine in order to fuel a mine-mouth electric generating facility. Approximately 141 million tons of lignite will be removed. As a result of the mining activities, the geologic units overlying the mineable lignite seams will experience unavoidable adverse impacts. While the overall texture of the material (i.e., sand, silt or clay) will be unchanged, the stratigraphic relationships and the physical characteristics of the individual geologic units above the removed lignite seam will be permanently altered. Disruption of oil and gas wells in the mined area could be short term or long term as production at a given location can resume once mining and reclamation activities are completed in that area.

Iron-ore gravel is currently being mined within the permit area. Lignite operations would destroy additional gravel resources in the mined area, making the irretrievable loss of that potential resource a long-term adverse impact.

5.1.2.5 Combined Impacts of Power Plant and Mine

Adverse impacts to the geological resources within the power plant and mine site include the loss of the lignite seams as geologic units, the destruction of specific geologic units located above the mineable lignite, and the possible short-term incremental preclusion of the development of other resources (i.e., oil and gas) as proposed mining operations traverse the permit area. Loss of gravel resources within the mined area will constitute an irretrievable commitment of a natural resource.

5.1.3 Soils

A more detailed discussion of the proposed Dolet Hills Surface Lignite Mine Project soils is presented in the soils baseline report for the proposed project area (EH&A, 1980b).

5.1.3.1 Existing Environment

Soils of the proposed Dolet Hills Lignite Mine Project may be placed in three major soil groups, each of which contains soils that differ significantly from those of the other groups: (1) soils of the uplands (Group A); (2) bottomland soils of local streams (Group B); and (3) bottomland soils of the Red River (Group C).

The location of these groups is shown in Figure 5-1(a and b). Soil components within each group, acreages, and percentage of the total permit area are given in Table 5-1.

Upland soils (Group A) occur on approximately 11,328 hectares (27,991 acres) and constitute 94.6 percent of the permit area. Typically, these are highly weathered soils that have well-defined A, B, and C horizons. The deposits in which they developed are of Tertiary age or, in places along old stream terraces, of Pleistocene age. These soils are acidic, at least in the upper part. Most have sandy surface layers and clay or sandy clay loam subsurface layers. A few have silt loam surface layers and silt loam or silty clay loam subsurface layers. Slopes range from gently sloping to steep. Many of these soils are in mixed hardwood and pine forests. Some are used for pasture; very few are presently used for cultivated crops.

Bottomland soils of local streams (Group B) occur on approximately 549 hectares (1,357 acres) and are developed primarily in alluvial sediments washed from surrounding upland areas. For the most part, they lack well-defined horizon development although some of the soils on low terraces have developed an A-B-C horizon sequence. Typically, the soils in this group have sandy loam or silt loam surface layers and, except for the low terrace soils, stratified sandy or loamy subsurface layers; most are acidic. These are nearly level soils that flood too frequently for crop cultivation. They are primarily in forests of gum, oak, maple, ash, hickory, and some pine. A few small areas are in pasture.

Bottomland soils of the Red River (Group C) in the permit area occupy only 78.5 hectares (194 acres). They have developed in alluvial sediments that came mostly from the

TABLE 5-1
SOIL MAPPING UNITS WITHIN MAJOR SOIL GROUPS OF THE PROPOSED DOLET HILLS LIGNITE MINE PROJECT

Major Soil Groups and Their Components	Acres[a]	Percent of Permit Area
A - UPLAND SOILS		
Bowie fine sandy loam, 1 to 5 percent slopes	6,889	23.3
Briley loamy fine sand, 1 to 5 percent slopes	1,341	4.5
Briley loamy fine sand, 5 to 12 percent slopes	1,303	4.4
Forbing very fine sandy loam, 1 to 3 percent slopes	145	0.5
Forbing very fine sandy loam, 3 to 8 percent slopes	523	1.8
Kirvin fine sandy loam, 1 to 5 percent slopes	1,693	5.7
Kirvin fine sandy loam, 5 to 30 percent slopes	4,365	14.8
Kirvin-Woodtell-Briley association, hilly	2,877	9.7
Metcalf silt loam	340	1.1
Ruston fine sandy loam, 1 to 3 percent slopes	202	0.7
Woodtell fine sandy loam, 1 to 5 percent slopes	4,703	15.9
Woodtell fine sandy loam, 5 to 12 percent slopes	3,610	12.2
SUBTOTAL	27,991	94.6

TABLE 5-1 (Concluded)

Major Soil Groups and Their Components		Acres	Percent of Project
B - BOTTOMLAND SOILS OF LOCAL STREAMS			
Guyton and Iuka soils, frequently flooded		292	1.0
Iuka and Ochlockonee soils, frequently flooded		1,065	3.6
	SUBTOTAL	1,357	4.6
C - BOTTOMLAND SOILS OF THE RED RIVER			
Moreland clay		13	0.1
Perry clay, occasionally flooded		181	0.6
	SUBTOTAL	194	0.7
	GRAND TOTAL	29,542[a]	99.9[b]

a. See Conversion Chart for metric equivalent.

b. Water equals 3 acres (0.1 percent).

Source: SCS criteria as defined in the Federal Register, Vol. 43, No. 21 (Tuesday, January 31, 1978), Section 657.56.

Permian "red beds" of Oklahoma and Texas and were deposited by the Red River. These are young, relatively unweathered soils. Surface and subsurface layers are mostly clay. These soils are less acidic than others within the permit area. They are productive, especially for soybeans and pasture, where protected from flooding and where an adequate drainage system has been installed. However, most of these soils are not protected from flooding and are primarily in bottomland hardwood forests.

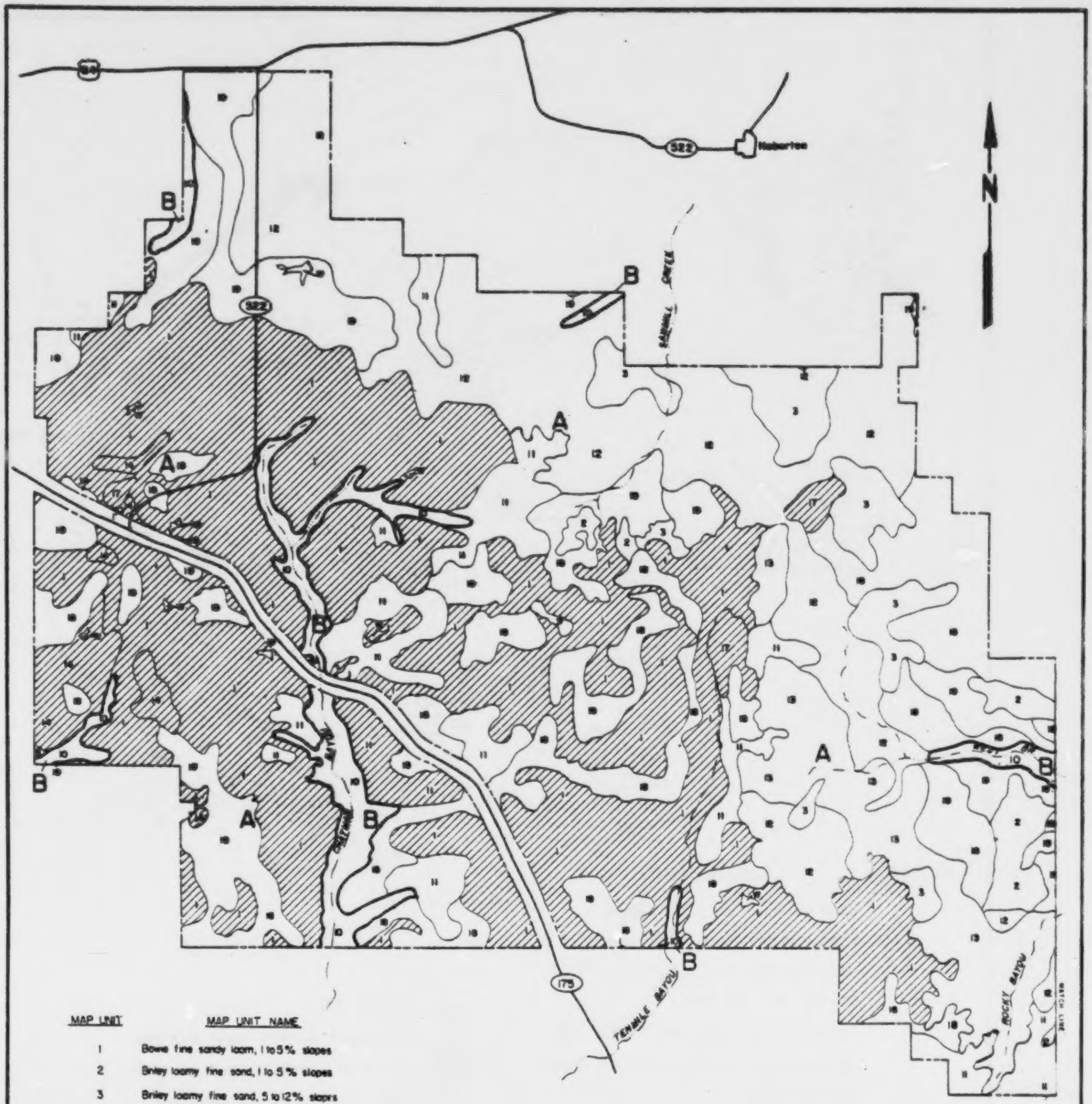
Prime Farmland. Figure 5-1(a and b) shows the distribution within the permit area of prime farmland as defined by the U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS) in Section 657.5(a) of CFR 43, No. 21, dated Tuesday, January 31, 1978. Table 5-2 shows which soil map units qualify as prime farmland under the SCS criteria and the acreages and proportions involved.

Approximately 3,013 hectares (7,444 acres, or 25.2 percent) within the permit area qualify as prime farmland under SCS criteria. Of this, 3,007 hectares (7,431 acres, or 25.1 percent of the permit area) is on uplands, primarily in the western part, most of which is mapped as Bowie fine sandy loam, one to five percent slopes. Because of flooding, none of the bottomland soils along local streams qualify as SCS prime farmland. Only 5.3 hectares (13 acres, or 0.1 percent of the permit area) of Red River bottomland soils qualify as prime farmland under SCS criteria.

In Louisiana, the definition of prime farmland for surface mine permitting purposes is contained in the Louisiana Surface Mining Regulations (LSMR) 100.5(78). A historical land-use survey, based on LSMR criteria, was conducted in 1981 on all lands defined as prime farmland by the SCS within the permit boundary (Allison, 1981). The survey showed that approximately 27.5 hectares (68 acres, or 0.2 percent of the permit area), located primarily on a dairy farm, qualified as prime farmland.

Soil Capability Groups. The SCS uses a land capability classification system to rate soils for determining, in a general way, how suitable they are for most kinds of farming. The system is based primarily on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. In this system, soils are grouped at three levels: the capability class, subclass, and unit.

The capability classes are designated by Roman numerals I through VIII. In Class I are soils that have few limitations, the widest range of use, and the least risk of damage when


84
522
Keltys
N
B
A
SAWMILL CREEK
CASTILE
TENMILE BAYOU
ROCKY BAYOU
175
MATCH LINE
1
2
3
10
11
12
13
15
16
17
18
19

MAP UNIT	MAP UNIT NAME
1	Bowie fine sandy loam, 1 to 5% slopes
2	Briley loamy fine sand, 1 to 5% slopes
3	Briley loamy fine sand, 5 to 12% slopes
5	Caspiana silty clay loam
6	Forbing very fine sandy loam, 1 to 3% slopes
7	Forbing very fine sandy loam, 3 to 8% slopes
8	Gallion silt loam
9	Guyton and Iuka soils, frequently flooded
10	Iuka and Ochlockonee soils, frequently flooded
11	Kirvin fine sandy loam, 1 to 5% slopes
12	Kirvin fine sandy loam, 5 to 30% slopes
13	Kirvin-Woodtell-Briley association, hilly
14	Metcalf silt loam
15	Moreland clay
16.	Perry clay, occasionally flooded
17	Ruston fine sandy loam, 1 to 3% slopes
18	Woodtell fine sandy loam, 1 to 5% slopes
19	Woodtell fine sandy loam, 5 to 12% slopes
W	Water

A	Upland soils
B	Bottomland soils of local streams
■	Bottomland soils of the Red River
▨	SCS classified prime farmland

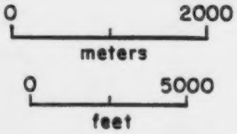
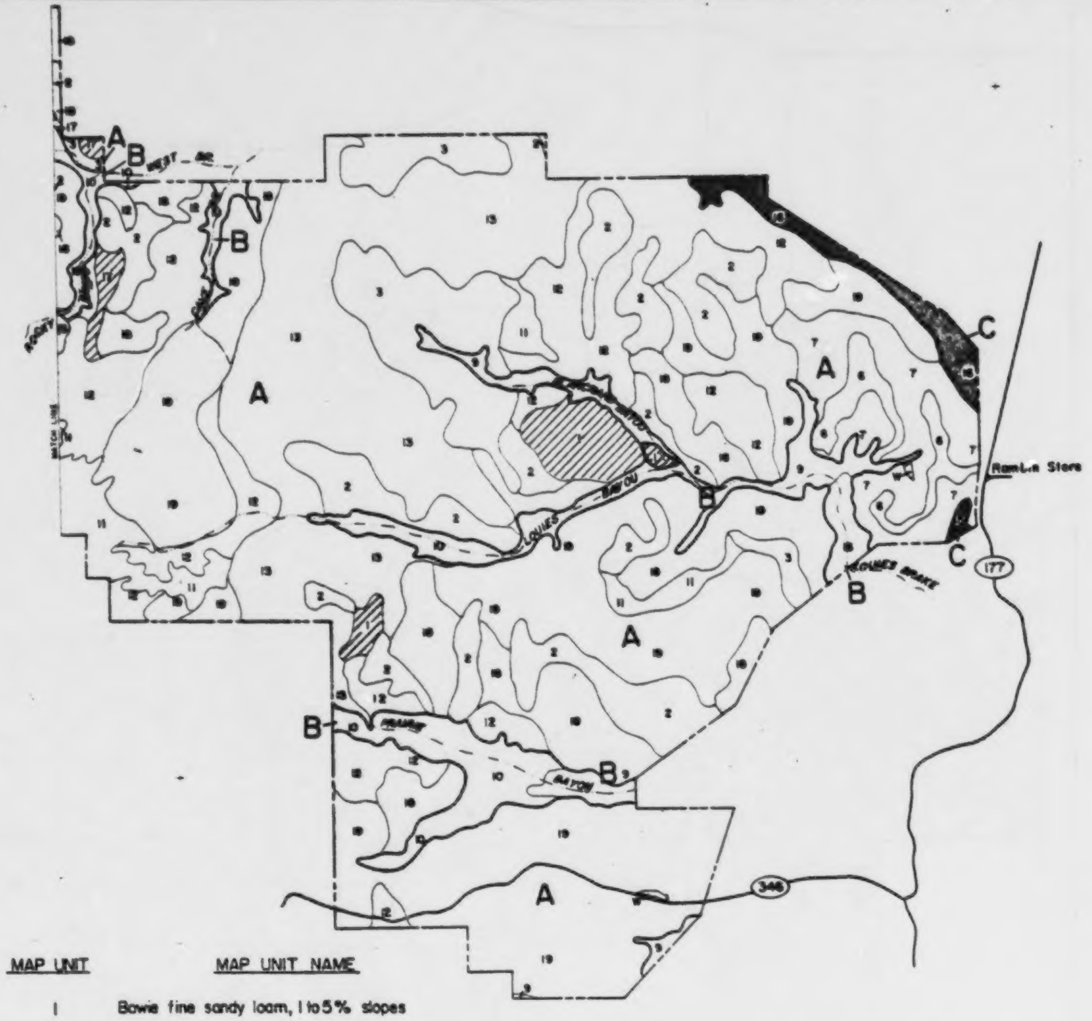

0
2000
meters
0
5000
feet

FIGURE 5-1a
SOILS OF THE PERMIT AREA
West Area

SOURCE: EH&A


A
B
A
A
A
A
B
B
B
C
C
Ramlin Store
177
346
Louies Bayou
Louies Brake
Bayou
Match Line

MAP UNIT	MAP UNIT NAME
1	Bowie fine sandy loam, 1 to 5% slopes
2	Briley loamy fine sand, 1 to 5% slopes
3	Briley loamy fine sand, 5 to 12% slopes
5	Caspiana silty clay loam
6	Forbing very fine sandy loam, 1 to 3% slopes
7	Forbing very fine sandy loam, 3 to 8% slopes
8	Gallion silt loam
9	Guyton and Iuka soils, frequently flooded
10	Iuka and Ochlochonee soils, frequently flooded
11	Kirvin fine sandy loam, 1 to 5% slopes
12	Kirvin fine sandy loam, 5 to 30% slopes
13	Kirvin-Woodtell-Briley association, hilly
14	Metcalf silt loam
15	Moreland clay
16	Perry clay, occasionally flooded
17	Ruston fine sandy loam, 1 to 3% slopes
18	Woodtell fine sandy loam, 1 to 5% slopes
19	Woodtell fine sandy loam, 5 to 12% slopes
W	Water

A Upland soils
B Bottomland soils of local streams
■ Bottomland soils of the Red River
▨ SCS classified prime farmland

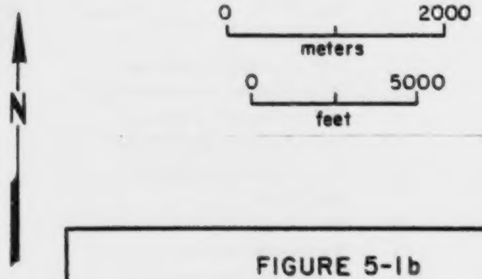

N
0
2000
meters
0
5000
feet

FIGURE 5-1b
SOILS OF THE PERMIT AREA
East Area

SOURCE: EH&A

TABLE 5-2
SOIL CAPABILITY GROUPS AND PRIME FARMLAND WITHIN THE MINE PERMIT AREA

Major Soil Groups and Their Components	Capability Group	Prime Farmland		
		Yes/No	Acres[a]	Percent of Project
A - UPLAND SOILS				
Bowie fine sandy loam, loam, 1 to 5 percent slopes	IIIe	Yes	6,889	23.3
Briley loamy fine sand, 1 to 5 percent slopes	IIIs	No	---	---
Briley loamy fine sand, 5 to 12 percent slopes	IIIs	No	---	---
Forbing very fine sandy loam, 1 to 3 percent slopes	IIIe	No	---	---
Forbing very fine sandy loam, 3 to 8 percent slopes	IVe	No	---	---
Kirvin fine sandy loam, 1 to 5 percent slopes	IIIe	No	—	—
Kirvin fine sandy loam, 5 to 30 percent slopes	VIe	No	---	---
Kirvin-Woodtell-Briley association, hilly	VIw	No	---	---
Metcalf silt loam	IIIw	Yes	340	1.1
Ruston fine sandy loam, 1 to 3 percent slopes	IIe	Yes	202	0.7
Woodtell fine sandy loam, 1 to 5 percent slopes	IIIe	No	---	---
Woodtell fine sandy loam, 5 to 12 percent slopes	VIe	No	---	---
	SUBTOTAL		7,431	25.1
B - BOTTOMLAND SOILS OF LOCAL STREAMS				
Guyton and Iuka soils, frequently flooded	Vw	No	---	---
Iuka and Ochlockonee soils, frequently flooded	Vw	No	---	---
	SUBTOTAL		0	0.0
C - BOTTOMLAND SOILS OF THE RED RIVER				
Moreland clay	IIIw	Yes	13	0.1
Perry clay, occasionally flooded	IVw	No	---	---
	SUBTOTAL		13	0.1
	GRAND	TOTAL	7,444	25.2

a. See Conversion Chart for conversion to metric equivalent.

Source: SCS criteria as defined in the Federal Register, Vol. 43, No. 21 (Tuesday, January 31, 1978), Section 657.56.

they are used. Soils in higher numbered classes have progressively greater natural limitations. As a general rule, soils in Classes I through III are suitable for row crops, those in Class IV are suitable for sown crops (in some instances row crops), and those in Classes V through VIII are limited largely to pasture, woodland, and similar uses.

Subclasses indicate major kinds of limitations within the classes and are designated by adding a small letter to the class numeral. Class I soils do not have subclasses because their limitations are so minor. In Table 5-2, the letter "e" means the main limitation is risk of erosion, unless close-growing plant cover is maintained; "w" means that water in or on the surface will interfere with plant growth or cultivation, unless the soil can be adequately drained. The symbol "s" shows the soil is limited mainly because it is droughty, shallow, or stony.

Soils in the upland areas of the mine permit area are in capability Classes II, III, and VI. The more severe limitations are due primarily to steepness of slope. The major kind of limitation is risk of erosion. Two of the map units are limited by wetness, and two by the nature of the soil (the Briley soils tend to be droughty because of their thick, sandy surface).

The bottomland soils of local streams are all in capability Group Vw. These soils flood; thus, are generally not suited for cultivation.

The bottomland soils of the Red River are in capability Classes III and IV. The main limitation is wetness, as indicated by the subclass "w" assigned to them. Soils in map unit Perry clay, occasionally flooded (capability Group IVw), are generally not suited for cultivated crops because of flooding and wetness.

Overburden Assessment. Nineteen continuous overburden cores have been collected from the project site for laboratory analyses (Figure 5-2a and b and Appendix C). The data, plus field examinations, indicate that the surface 4.5- to 6.1-meter (approximately 15 to 20 feet) increment is oxidized, as evidenced by yellow, orange, and brown colors; the absence of pyritic sulfur; and low values for net potential acidity. Field test plots indicate that overburden materials from this zone are equal to or better for plant growth than the existing weathered upland soils (Harbert, 1982).

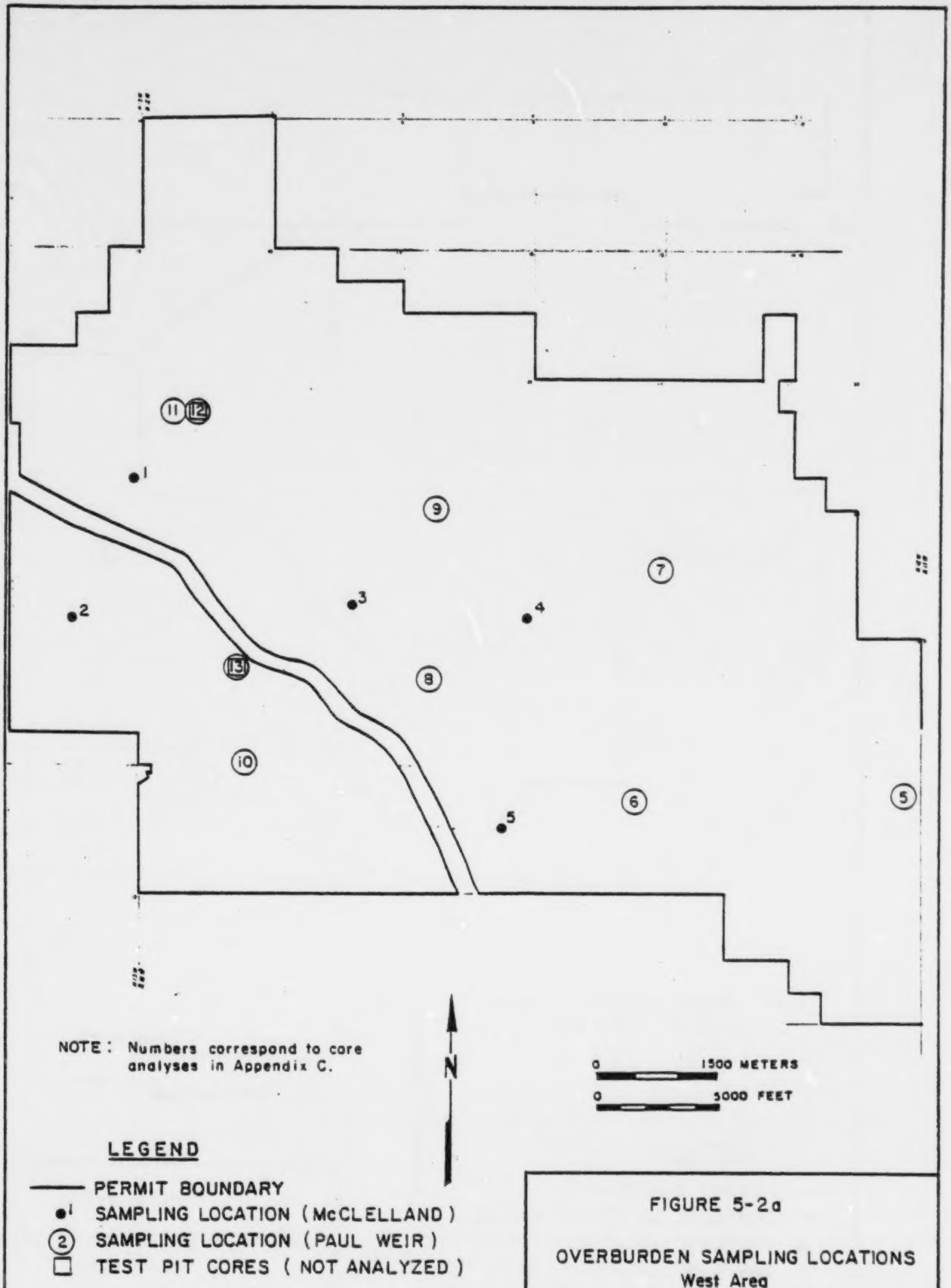
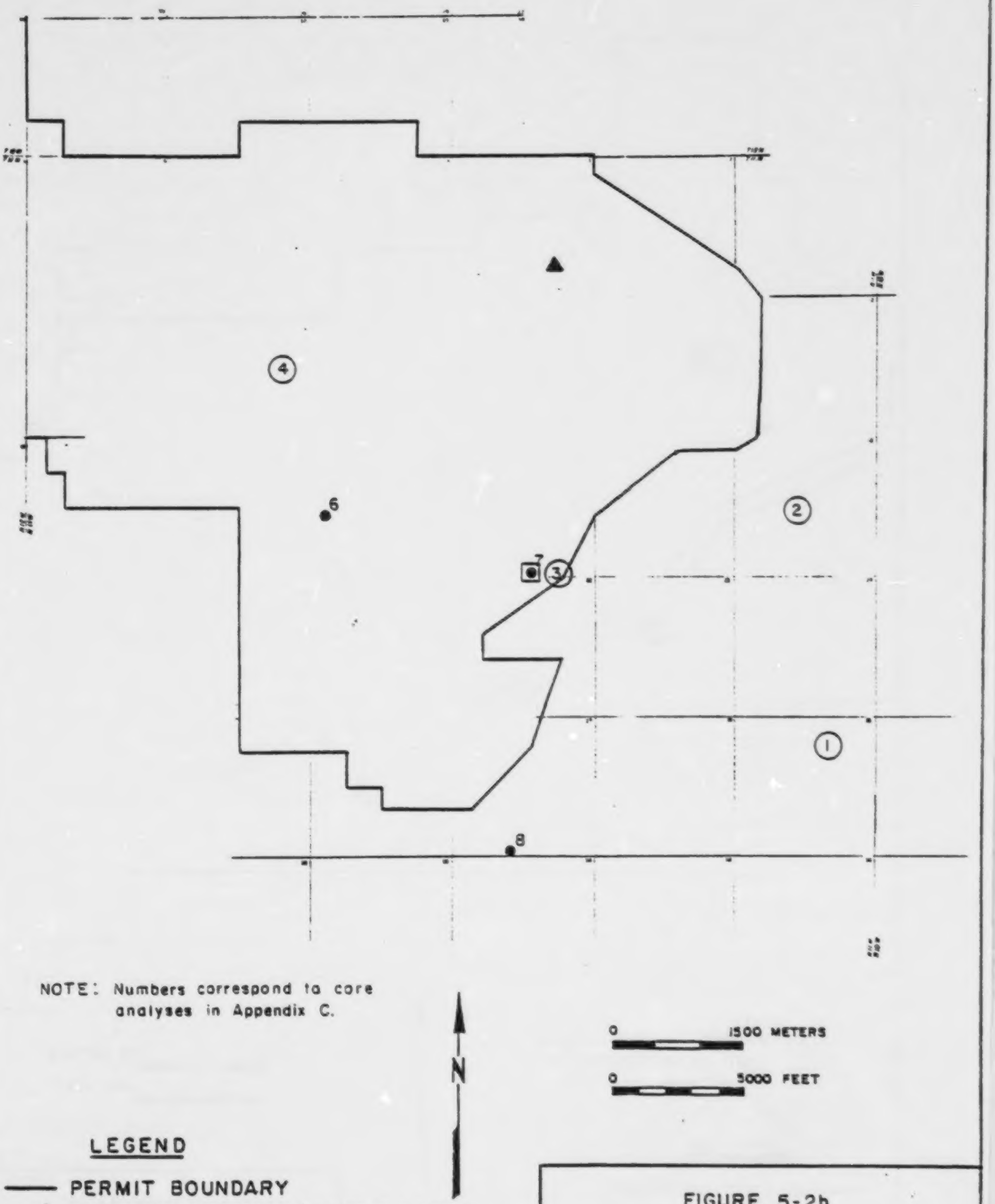

11
12
1
9
7
2
3
4
13
8
10
5
6
5
N
NOTE: Numbers correspond to core analyses in Appendix C.
0
1500 METERS
0
5000 FEET
LEGEND
PERMIT BOUNDARY
●1 SAMPLING LOCATION (McCLELLAND)
② SAMPLING LOCATION (PAUL WEIR)
☐ TEST PIT CORES (NOT ANALYZED)

FIGURE 5-2a

OVERBURDEN SAMPLING LOCATIONS
West Area

Source: DHMV


4
2
6
7
3
1
8
0
1500 METERS
0
5000 FEET
N

NOTE: Numbers correspond to core analyses in Appendix C.

LEGEND

- —— PERMIT BOUNDARY
- ●¹ SAMPLING LOCATION (McCLELLAND)
- ▲ SAMPLING LOCATION (CLECO/SWEPCO)
- ② SAMPLING LOCATION (PAUL WEIR)
- ☐ TEST PIT CORES (NOT ANALYZED)

FIGURE 5-2b

OVERBURDEN SAMPLING LOCATIONS
East Area

Source: DHMV

Core data in Appendix C indicate that soil textures for the most part are sandier within the unoxidized zone (occurring below depths of about 4.5 to 6.1 meters; 15 to 20 feet) than within the oxidized zone nearer the surface. This is illustrated, with few exceptions, in Cores 1, 3, 4, 6, 7, 9, 10, and 11 of Table 1 (Appendix C), where sandy loams, loamy sands, and sands generally occur above the major lignite seam. (The major lignite seam in Table 1 can be identified by a break in depth sequence, for example the 76.3- to 84.3-foot zone in Core 9). Cores 1, 2, 3, 4, 5, 6, and 8 in Table 5 (Appendix C) illustrate the same principle. These lower layers contain less clay than the Bt horizons of most of the existing soils, described elsewhere (EH&A, 1980b).

Many layers within the unoxidized zone would require no liming to bring the acid-bearing potential within tolerances of 5 tons of calcium carbonate requirement per thousand tons of material (an acre-furrow slice). Materials containing an acid-bearing potential requiring more than 5 tons of calcium carbonate or its equivalent per thousand tons of material are considered potentially toxic by Smith and Sobek (1978). There are layers above the lignite which exceed this limit. Such layers occur in Cores 6 (91.9-118.5 feet); 7 (100.9-104.0 feet); 8 (25.0-31.7 feet and 59.8-102.1 feet); 9 (65.5-76.3 feet); 10 (27.5-46 feet, 67.3-84.9 feet, and 112.5 to 128.7 feet); and 11 (31.6-44.9 feet, 49.8-64.8 feet, and 79.7-87.4 feet) (see Table 1, Appendix C). Similar examples are found in Cores 2, 3, and 6 (Table 5, Appendix C). Assuming a uniform total mix, the neutralization potential will exceed the acid-forming potential in most cores. However, a total mix is rarely accomplished during mining operations. Thus, where the unoxidized material is placed on the surface, the possibility exists that materials having a high acid-bearing potential will occur locally on the surface unless such materials are selectively buried during mining operations.

Throughout all cores, calcium is the dominant cation as compared to sodium or potassium. This means that, within the exchange complex, there is no danger of producing post-mined soils that are sodium saturated. Excessive sodium produces undesirable physical and chemical characteristics within soils, a condition not found where calcium is dominant.

Heavy minerals, as indicated in Table 3, Appendix C, are within accepted tolerances insofar as toxicity to plants and animals is concerned (Aubert and Pinta, 1977), and generally are no higher within subsurface layers than in surface layers, which include the existing soils. The only condition under which toxic ranges might exist would be where such minerals are mobilized by the oxidation of high acid-bearing materials, with subsequent concentration in runoff waters (Smith and Sobek, 1978).

5.1.3.2 Effects of No Action

The no action alternative would eliminate the adverse impact of construction and operations related to the proposed project. However, the effects of no action on the proposed project site depend to a large extent on future land use and management. For several decades, land-use trends on upland soils in north Louisiana have seen a reduction in cropland, with a corresponding increase in improved pastures and timber production. Accelerated erosion under these uses should be minimized, although erosion will continue where vegetative cover is sparse. Small areas along bottomlands of local streams and bottomlands of the Red River, if drained and protected from flooding, would change from nonprime to prime farmland. Large-scale practices of this nature are highly unlikely because of the expense involved versus monetary returns.

Although not a surface mining impact, it should be noted that ongoing extensive urban development in Caddo and Bossier parishes is accounting for the loss of large portions of prime farmland in the region; urban expansion is a leading cause of the loss of prime farmland (Ramsey and Corty, 1982).

5.1.3.3 Construction Impacts

Land clearing prior to construction of mine facilities within the mine ancillary activity area will create short-term adverse impacts associated with accelerated erosion, particularly on soils with steep slopes. Appropriate mitigative measures, such as reseeding disturbed areas after construction, will be employed to lessen this adverse effect. Conversion of soils from agriculture and developed forestry (approximately 0.9 hectares (2.2 acres) and 4.9 hectares (12.1 acres), respectively) to mine facilities (industrial) use is an unavoidable adverse impact for the life of the proposed mine, resulting in a commitment of these resources. Once the project is completed, facilities within the ancillary activities area will be dismantled, and the land will be reclaimed according to landowner preference.

5.1.3.4 Operation Impacts

The impacts of mining operations on soils would include: potential for accelerated erosion; chemical and physical properties of soils; subsidence (discussed in Section 5.1.1.4) and changes in prime farmland status.

Potential Accelerated Erosion. A potential for accelerated erosion will exist on sloping areas that have been cleared of vegetation prior to mining, resulting in an unavoidable adverse impact. Compared to the size of the mine, the acres cleared of vegetation at a given point in time will be relatively small, averaging about 195 hectares (483 acres) per year for the life of the mine. This is a short-term adverse impact in that erosion rates will be minimized as soon as vegetation is re-established following postmine grading and reclamation.

Chemical and Physical Properties. Without precise reconstruction of soils, no mining procedure will exactly duplicate the existing soils. Thus, any procedure will result in long-term, irreversible impacts insofar as morphology and composition of existing soils is concerned. Whether these impacts are adverse (or beneficial) depends upon the nature of the existing soils versus that of the postmined soils.

Selective Placement of Materials (DHMV's Preferred Alternative). During initial stages of mining, the preferred mine plan calls for replacement of existing soils with selected sandy layers of unoxidized overburden material that lies above the lignite seam. Where such layers are absent, selected layers from the oxidized zone would be used. The use of unoxidized overburden would create short-term, reversible impacts in surface layers due to low organic matter and microbial content (Fresquez and Lindemann, 1982). Texture of the reconstructed soils would be sandier throughout (particularly in the subsoil) than that of the existing soils, except possibly the Briley series. Should the overburden material be excessively sandy, productivity would probably be similar to that of the Briley soils, which are described (EH&A, 1980b; USDA, 1980) as having a poor potential for cultivated crops and pastures, and a good potential for pine forests. Where soils are excessively sandy, they dry out quickly and are droughty. Production for cultivated crops and pasture is somewhat limited. Under these conditions there would be no adverse effects on forest productivity, but future uses for crops or pasture might have long-term, irreversible adverse impacts on productivity ratings. Discussion of productivity rates for the Dolet Hills Mine occurs in Section 4.4.5. Over parts of the area, materials immediately above the lignite seam have a high potential acidity (Section 5.1.3.1, Overburden Assessment). Under worst case conditions, the use of unoxidized materials could locally create soils that have a high acid-bearing potential. Such conditions could be detrimental to plant growth and could mobilize toxic elements, which would be subject to transport in runoff waters. Unless corrected, this would create long-term, irreversible adverse impacts. Should such conditions occur, however, Section 216.48 of the LOCSMD regulations requires burying or otherwise treating all acid-forming and toxic-forming spoil within 30 days after it is first exposed on the mine site. Under these conditions, the impact would be short-term and reversible. A period of time substantially longer than 30 days would be required before oxidation of pyritic materials in the exposed overburden would result in substantial acid formation. Upon exposure to the atmosphere, pyrite minerals are initially oxidized through relatively slow chemical pathways until the interstitial water reaches about pH 3. At that point, biological oxidation mediated by Thiobacillus spp., and allied forms, can proceed. The rate of the initial, purely chemical, oxidation is limited (depending on specific conditions) by factors that include the rate of oxygen diffusion into the spoil, the surface area of pyrites available for oxidation (inversely proportional to particle size), and the prevalence of reaction pathways that compete for available oxygen, such as the metabolic demands of the soil microflora colonizing the spoil. During mining operations, the proposed mine plan calls for selective burial of materials having a high acid-bearing potential, while sediment control structures discussed in Section 4.4.4.6 would trap any material that might be eroded from spoil piles during surface exposure, preventing the deposition of any significant amounts of pyritic minerals in area water courses. If correctly carried out, there will be no adverse impacts due to placement of acid-bearing materials on the surface.

Where unoxidized sandy materials are absent, the use of selected oxidized materials would create soils having more clayey surfaces than those of existing soils. Surface crusting and low organic matter and microbial content would create short-term, reversible adverse impacts. Upon correction of these impacts by revegetation and fertilization, productivity should be equal to that of existing soils. This has been demonstrated on oxidized overburden with field test plots conducted by Central and South West Services, Inc. (Harbert, 1982) (see Section 4.4.5).

Topsoil Segregation and Replacement. The alternative of topsoil segregation and replacement over a random overburden mix would create soils with surfaces similar to that of existing soils. Subsurface layers would be somewhat heterogeneous in nature.

There should be no short-term adverse impacts to surface layers due to surface crusting or localized acidity. The soils should have a productivity capacity equal to that of the existing soils.

No Selective Placement. Overburden data indicates that a random overburden mix without selectivity would create soils somewhat heterogeneous in nature. This is due to the wide range in properties (particularly texture and potential acidity) of layers within the overburden. The average soil will be less sandy than where the preferred alternative is used. Surface crusting and low organic matter and microbial content will have short-term, reversible adverse impacts, in effect until vegetation is reestablished. Due to incomplete mixing, small and localized areas of highly acidic materials would offer short-term, adverse effects which could inhibit plant growth in localized areas. Following correction of these areas by liming, removal and reburying, and/or topsoiling, the reconstructed soil should have a favorable balance of chemical and physical properties. Production for most agricultural uses should equal that of existing soils.

In summary, productivity and postmined soils by any of the alternatives discussed can be equal to that of existing soils, provided excessively sandy materials (USDA textures of sand and loamy sand) are avoided. Even these soils can have good forest productivity, but future use for cultivated crops and pastures would be limited.

Prime Farmland. As discussed earlier, prime farmland soils, using SCS criteria (Table 5-2), exist on about 3,013 hectares (7,444 acres, or about 25 percent) of the mine permit area. SCS prime farmland will be directly and adversely impacted only where it is present in the mined blocks and construction sites in the ancillary area. In the total permit area, about 27.5 hectares (68 acres) has a land use history that qualifies as prime farmland under Louisiana Surface Mining Regulations (Allison, 1981).

Selective Placement of Materials (DHMV's Preferred Alternative). The reconstructed soils would no longer have the characteristics of existing soils. Use of the preferred alternative (replacing existing soils with selected sandy layers of unoxidized overburden material) would create soils sandier than now exists on prime farmland areas, particularly within the subsoil. Short-term impacts would be similar to those described earlier. Forestry production should be equal to that of existing prime farmland soils, but the sandy nature of the reconstructed soil may limit the productive capacity for cultivated crops and pasture. Reconstructed soils having textures of loamy fine sand or sand would probably no longer qualify as prime farmlands under SCS criteria and would therefore constitute an irretrievable loss. One of the criteria is that the available water capacity within a depth of one meter (3.2 feet) be sufficient to produce commonly grown cultivated crops adapted to the region in seven or more years out of ten. This is the primary reason SCS does not classify the Briley series (sandy soils) within the mine permit as prime farmland.

The use of selected layers within the oxidized layer in the absence of sandy unoxidized materials would create more clayey surfaces than those of existing soils. Short-term, reversible adverse impacts under this procedure have been discussed. Once these have been corrected, the reclaimed soils would probably have an available water holding capacity approaching that of the existing soils. They would probably be adapted to most crops within the area. Final qualifications as SCS - designated prime farmland would depend on whether or not they met the criteria for such classification. If criteria are not met, SCS prime farmland status would be irretrievably lost.

Topsoil Segregation and Replacement. The alternative of topsoil segregation replacement over a random overburden mix would provide surface layers equivalent to those of existing prime farmland soils. Subsurface layers would be heterogeneous, with properties discussed above for a total mix. Classification as prime farmland would depend on the nature of the overburden criteria for SCS - designated prime farmland. SCS considers subsoil as well as surface characteristics.

No Selective Placement. Properties of postmined soils on a random overburden mix has been discussed previously. Localized, highly acidic areas would no longer qualify as prime farmland. Upon correction of this and other short-term adverse impacts the soil properties would be such that crops common to the area can be grown. In places the resulting soil would have similar textures, at least within the subsoil, to those of existing prime farmland soils. Some areas would be more sandy and others more clayey. Some would undoubtably have qualifications for prime farmland, while others might not.

5.1.3.5 Combined Impacts of Power Plant and Mine

Combined impacts during construction of the power plant, transportive facilities, and ancillary mining facilities will mainly involve a short-term potential for accelerated erosion due to vegetative clearing activities involved with construction.

Combined operational impacts will involve the adverse impact of conversion of soils from agricultural (136.5 hectares or 337.2 acres) and forestry (301.7 hectares or 745.5 acres) uses to plant site, transportive systems, and ancillary mine facilities (industrial use). This conversion will last for the life of the project (32-35 years). The main operational impact, however, will involve a potential for short-term accelerated erosion between the time land is cleared for overburden removal and prior to revegetation following postmine grading and vegetative reclamation.

No prime farmland is involved on the plant site. Relatively small acreages will be involved where the blowdown discharge pipeline and the railroad cross soils of the Red River bottomlands east of the mine site (EPA, 1981). Approximately 27.5 hectares (68 acres) of prime farmland, as defined by the LSMR, will be adversely affected by mining operations. If final qualifications as SCS-designated farmland are not met after reclamation of the mined areas, approximately 2,972 hectares (7,431 acres) of prime farmland could be irretrievably lost.

5.2 WATER RESOURCES

5.2.1 Ground Water

5.2.1.1 Existing Environment

Ground water within the permit area and vicinity exists within four geohydrologic units in variable quantities and quality. These units are the Naborton, Dolet Hills, and Cow Bayou formations of the Wilcox Group; and the Quaternary alluvium and terrace deposits associated with the Red River and its tributaries. A water well inventory was conducted and information was compiled from records of the Louisiana Department of Water Works, the U.S. Geological Survey (USGS), and Espey, Huston & Associates, Inc. (EH&A, 1980a). Approximately 120 ground-water wells were located adjacent to the permit area and approximately 80 within the permit area. Of the total, 75 percent of the wells are completed into the Dolet Hills Formation, 10 percent into the Naborton, and 15 percent into alluvial deposits or water bearing units below the Dolet Hills and Naborton. The most common use of the ground water in the area is for domestic or stock purposes.

Ground water occurs under both confined and unconfined conditions within the permit area. Unconfined conditions exist in the areas of outcrop of the water bearing units, or

TABLE 5-3

GROUNDWATER QUALITY DATA FROM THE NABORTON AND DOLET HILLS FORMATIONS

Constituent	USEPA Interim Primary & Secondary Drinking Water Regulations	Dolet Hills Formation						Naborton Formation						
		8D 2-80	12D 2-80	15D 2-80	22D 2-80	24D 2-80	25D 2-80	1N 2-80	4N 2-80	6N 1-24-80	7N 2-80	14N 2-80	19N 2-27-80	23N 1-21-80
pH	6.5-8.5	7.2	4.3	4.9	6.4	6.0	6.5	7.7	8.0	6.6	8.6	7.2	7.0	7.2
Conductivity (µmhos/cm)	NS	1900	38	4.2	84	58	160	940	1500	120	2600	230	260	260
Alkalinity (as $CaCO_3$)	NS	950	6	4	40	14	48	348	52	60	558	128	56	110
Hardness (as $CaCO_3$)	NS	940	7	6	12	19	44	38	19	14	22	8	61	50
Total Dissolved Solids	500	1610	52	68	88	72	182	572	1018	102	772	212	192	220
Nitrogen (Nitrate as N)	10	0.16	0.23	0.59	0.28	0.47	0.04	< 0.01	0.01	0.03	0.01	0.01	0.17	0.03
Sulfate	250	70	3	5	7	6	17	63	2	20	1	1	4	16
Chloride	250	466	12	12	74	5	18	58	427	14	796	14	71	31
Fluoride	1.8	20.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aluminum	NS	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06		< 0.06
Arsenic	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
Beryllium	NS	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
Cadmium	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
Calcium	NS	67.8	1.0	1.1	1.3	1.5	6.5	6.0	3.7	0.50	4.4	2.0		1.0
Chromium	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.08	< 0.05	< 0.05	< 0.05	< 0.05		< 0.05
Copper	1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
Iron	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.10	0.2	0.1		0.1
Lead	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		< 0.05
Magnesium	NS	54.0	0.6	0.7	1.5	2.0	4.7	4.4	1.5	0.60	2.2	0.9		0.20
Manganese	0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01		< 0.1
Mercury	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		< 0.001
Molybdenum	NS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.20	< 0.1	< 0.1		< 0.20

TABLE 5-3 (Concluded)

Constituent	USEPA Interim Primary & Secondary Drinking Water Regulations	Dolet Hills Formation 8D 2-80	12D 2-80	15D 2-80	22D 2-80	24D 2-80	25D 2-80	Naborton Formation 1N 2-80	4N 2-80	6N 1-24-80	7N 2-80	14N 2-80	19N 2-27-80	23N 1-21-80
Nickel	NS	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
Potassium	NS	8.0	2.9	2.5	1.8	3.1	5.9	12.3	12.1	4.8	17.4	13.5		6.20
Selenium	.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
Sodium	NS	236	3.7	5.1	3.5	4.1	14.7	139	314	19.00	265	54		57
Zinc	5.0	2.2	0.6	0.2	0.7	0.4	4.0	0.6	1.0	2.2	3.2	0.3		4.51

where the units are overlain only by alluvium. The direction of unconfined ground-water flow is topographically controlled with movement generally towards surface water drainages. Where confined conditions exist, the direction of ground-water flow is generally to the south and west, following the regional dip of the geologic stratum.

The Naborton Formation is the deepest geologic unit in the permit area that yields fresh water. Water level elevations within the Naborton are generally highest in the western portion of the permit area where the ground water is under confined conditions, and lower elevations occur in the northern portion where the Naborton outcrops or is directly overlain by alluvium. The primary sources of recharge to the Naborton are 1) from downward leakage from the Dolet Hills where clayey units of low permeability are thin or absent, thereby allowing the Naborton and Dolet Hills to be hydrogically connected (which occurs in portions of the western half of the permit area); 2) from the infiltration of precipitation falling directly on the outcropping strata of the Naborton Formation; and 3) from surface water where streams traverse the outcrop. Ground-water movement is generally towards the southeast, where it is discharged into the overlying alluvial materials of the Red River and its tributaries. Discharge of ground water from the Naborton can also occur by upward leakage into the Dolet Hills, as is the case in the eastern half of the site area, and from withdrawal of water through wells. Upward leakage is possible as a result of head differences between the two units and a confining layer of sufficient permeability to allow the water movement (Page and Pree, 1964). Head differentials result in artesian pressures throughout the permit area with a potentiometric level 15.6 to 31.3 meters (50 to 100 feet) above the top of the Naborton (EH&A, 1980a). Although the impermeable nature of the material at the top of the Naborton (i.e., clays and clayey silts) allows negligible leakage of Naborton water into the overlying Dolet Hills throughout most of the permit area, the absence of clays in the eastern portion of the permit area allows for upward leakage. Ground-water movement in the extreme western portion of the site is towards a ground-water sink created by the municipal wells providing backup water supplies for the community of Mansfield, which is northwest of the permit area.

Results of laboratory analysis of ground-water samples from seven wells completed into the Naborton Formation obtained on a quarterly basis for a one-year period indicate that the water quality of the Naborton is generally poor (Table 5-3). Concentrations of constituents in several samples exceeded the EPA drinking water standards (see Table 5-3). An average concentration of 550 mg/l and 130 mg/l for total dissolved solids

(TDS) and chlorides, respectively, were observed. An average iron concentration of 3.2 mg/l was observed (Table 5-3).

Ground-water resources of the Dolet Hills Formation exist for the most part under unconfined conditions within the permit area. Water level elevations of the Dolet Hills are highest in the western portion of the permit area where the outcrop area receives the highest rate of recharge (Pree, 1957). Recharge occurs primarily from direct infiltration of precipitation that falls on the area of outcrop. Other sources of possible recharge to the Dolet Hills Formation include inflow from surface water bodies during flood stage and upward leakage from the underlying Naborton Formation. The major sources of discharge from the Dolet Hills are seepage into the surface water drainage systems, withdrawal of ground water through wells, and downward leakage into the Naborton (which occurs in the western portion of the permit area). Ground-water movement generally is in a lateral direction towards surface water drainages.

Samples obtained from six wells completed into the Dolet Hills Formation indicate ground-water quality within the Dolet Hills is generally better than that of the Naborton Formation (Table 5-3). Results of laboratory analysis reflect good quality with concentrations of most parameters within the EPA drinking water quality standards. Iron, the only exception, is considered to be a secondary constituent and existed at levels higher than recommended in the standards ranging from less than 0.1 to 3.5 mg/l, and averaging 3.0 mg/l.

Ground water existing in the Cow Bayou Formation, which overlies the Dolet Hills, and the Quaternary alluvium and terrace deposits within the project area occurs under unconfined conditions. Water from these units is not used to any great extent in the region because of generally poor quality and low yields.

To further define the hydrogeologic properties of the water-bearing units within the permit area, aquifer pumping tests were performed. EH&A (1980a) provides a detailed description of the tests and the methods of determining the aquifer characteristics for the project area. Data was analyzed by preparing logarithmic and semi-logarithmic time-drawdown and time-recovery plots. In addition, the standard Theis Non-equilibrium Type Curve matching technique and the Jacob Straight-line technique were used to evaluate the hydraulic properties of the tested aquifers.

The results of the aquifer testing program indicate ranges of transmissivities in the Dolet Hills from 79 to 826 gpd/ft, averaging 534 gpd/ft; and a range from 29 to 602 gpd/ft in the Naborton, with an average 302 gpd/ft. Permeabilities in the Dolet Hills ranged from 5.5 to 54 gpd/ft^2, averaging 34 gpd/ft^2; and in the Naborton ranged from 1 to 24 gpd/ft^2, with an average of 15 gpd/ft^2.

5.2.1.2 Effects of No Action

The no action alternative would eliminate the adverse impacts of construction and operation related to the proposed project. Expected normal ground-water use and demand would be continued. Lignite development in the region is occurring and potential future lignite mining in the project area could adversely impact ground-water resources.

5.2.1.3 Construction Impacts

Mine construction activities primarily include the construction of haul roads and the conveyor system, dragline erection pads, and shop and office facilities. These activities will result in the disturbance of surface and shallow subsurface material over approximately three percent of the project area, but will not result in adverse impacts to the ground-water quantity or quality of the region.

5.2.1.4 Operation Impacts

The discussion of impacts to ground water resulting from mining operations is primarily directed towards the postmine usage of the ground-water supply as a resource. As previously discussed, the water-bearing formation above the mineable lignite, the Dolet Hills Formation, will be permanently altered geologically from its premining characteristics. In addition, the hydrologic characteristics of the formation will also be altered in terms of the nature of ground-water flow through the unit. Mixing the highly transmissive sand zones, where most ground-water flow occurs, with the lower permeability silty and clayey zones, will inhibit horizontal ground-water flow which may primarily impact the post-mine rate of recharge. Once the cast overburden becomes resaturated after mining is completed, the average potential yield of the unit should be similar to pre-mining yields.

Once mining and dewatering have been completed, the spoil will be subject to resaturation. There are three potential sources of water for resaturation of the postmine overburden: 1) infiltration of precipitation; 2) upwards leakage from water-bearing zones beneath the mined area; and 3) inflow from water-bearing zones adjacent to the mined area.

Mining may result in some increase of vertical permeabilities within the upper portion of the overburden relative to pre-mining vertical permeabilities. These permeabilities however, will decrease with increasing depth due to the compaction of the material. In general, the vertical flow is very low compared to horizontal flow in water bearing material because the primary flow paths within the sediment is in a lateral direction. Postmine recharge may be slightly reduced since the horizontal permeability of the mixed spoil is expected to be less than that of the premine overburden. Mining operations will result in the alteration of horizontal stratifaction of the overburden, therefore, horizontal permeabilities may be reduced prompting a reduction in the lateral flow through the cast overburden material. This reduction of lateral flow would decrease the amount of ground water recharging the postmine overburden material from the adjacent water-bearing zones. Consequentially, recharge from lateral inflow should only be effective within a few hundred feet of the periphery of the mine due to the relatively high water table conditions adjacent to the mined area and the resulting high ground-water hydraulic gradients. However, as the peripheral portions saturate and the hydraulic gradients decrease, inflow from adjacent sand bodies will decrease over time. Because of this reduced lateral inflow in the postmine material and the distance the ground water must travel, flow from adjacent units will be less effective in resaturating the material inward from the periphery. Therefore, lateral flow from adjacent units will be the major source of recharge to the peripheral portions, and infiltration of precipitation will serve as the major source of recharge over the interior portions of the postmine area.

The lower horizontal permeability of the reclaimed spoil is expected to slow the recoverability of the ground-water table. Observations by Kennedy and Pepper (1980) of reclaimed Gulf Coast surface lignite mines indicate that the ground-water table of a mined area had not recovered in a nine-year period after the completion of mining activities. Based upon similarities in the hydraulic and geologic characteristics between the project area and those observed in the Central Texas Gulf Coast area, a period of at least ten years may be necessary for the ground-water levels to return to approximate premining levels. Once ground-water levels have returned to premine conditions, the producibility, or potential yield, of the cast overburden should be comparable to the premining normal rate of use.

Another adverse impact to ground-water use resulting from mining operations concerns the loss of water wells in the area of mining due to the removal or abandonment of the well. Approximately 80 wells are located within the Dolet Hills permit area. Of these, it is estimated 60 percent of the wells (all drilled for domestic use) will be destroyed by mining operations, resulting in adverse impacts to a potential maximum of 1.37 million gallons per day (mgd) supplied by these wells. This volume assumes pumping at a maximum yield of 15 gallons per minute (gpm) per well for 24 hours.

When a well is not destroyed by excavation activities, it may be subjected to the short-term adverse impact of a decrease in productivity due to water-level drawdown from dewatering and/or depressurizing operations. The amount of drawdown in an area is mainly dependent upon the depth of mining and the distance the well is located from the excavated pit. Generally, when excavation takes place to depths below the potentiometric surface, the direction of ground-water flow in the vicinity of the mining activities will probably be towards the mine pit and/or its dewatering system. For any given mine cut, the volume of ground-water inflow into the pit, and the area affected by ground-water dewatering and/or depressurizing, will be dependent upon the following variables: the depth of active cut; the duration of cut; the position of the potentiometric surface relative to the depth of cut; the exposed aquifer thickness; the permeability of the aquifer; the storage coefficient of the aquifer; and the method of dewatering.

During mining, the quantity of ground water removed due to dewatering and/or depressurizing will vary, and withdrawal rates will depend upon the ground-water conditions and control methods employed at the mine at any given time. The specific yield of ground water in the project area is expected to be small enough to allow dewatering with sump pumping systems within the excavations. Wells and well points, in order to achieve advance dewatering, will be limited to those areas of higher specific yields and where depressurization is required.

The primary result of the dewatering and/or depressurizing operation will be a general lowering of ground-water levels over the area, thereby decreasing the yield of wells and adversely impacting those wells existing within the area of influence of the cone of depression created by the operation. Although the net water level reduction and the areal extent of influence for any given mine cut will depend upon the variables aforementioned, a range of estimates can be calculated to illustrate the various conditions which may be encountered in the mining area. To assess the extent of influence of pit dewatering, the following gravity flow formula was utilized:

$R = C(H - h_w)\sqrt{K}$ (from Dept. of the Army, Navy, and Air Force, 1971)

where,

R = the radius of influence;

$H - h_w$ = total drawdown; for the purposes of these calculations total saturation of overburden is assumed, therefore H is equal to overburden thickness (or depth of mining) and h_w is assumed to equal 0;

K = coefficient of permeability; and

C = coefficient for gravity flow. Assumed 3.0 to obtain a "worst case" result.

This analysis assumes a homogeneous overburden and examines a range of permeabilities based upon the results of aquifer pumping tests performed in the permit area (as reported in Section 5.2.1.1) and mining depths ranging from 10.7 meters to 42.6 meters (35 feet to 140 feet). The results, compiled in Table 5-4, express the distances from the mine pit that the water table will be impacted, i.e., the distance to zero drawdown.

To assess the drawdown distribution within the radii of influence, the "worst case" head of 42.6 meters (140 feet) was used (maximum depth of mining), and drawdown was calculated at various distances from the mine cut for water bearing zones of varying thicknesses and permeabilities. The results of these calculations are compiled in Table 5-5.

As the tables illustrate, the maximum distance of adverse impact by mining to the water table elevation will be less than one-half mile. This assumes the maximum depth of mining of 42.6 meters (140 feet) and a homogeneous water bearing strata with the highest permeability determined for the permit area. This analysis indicates that water levels in those wells in the permit area which are not destroyed by the mining operation will probably be impacted to some extent when excavation activities are within approximately one-half mile of the wells. However, adverse impacts to the productivity of ground-water wells lying outside the one-half mile area of impact should be minimal. Water for the mine offices will be drawn from wells in the Dolet Hills Formation and will be treated for drinking, if necessary. Equipment washing will be done with untreated well water while

TABLE 5-4
PROJECTED RADIUS OF INFLUENCE (FEET)[a] OF PIT DEWATERING

Total Drawdown	Coefficient of Permeability			
	1.4 gpd/ft^2 (0.66 x 10^{-4} cm/sec)	5.3 gpd/ft^2 (2.5 x 10^{-4} cm/sec)	24 gpd/ft^2 (113 x 10^{-4} cm/sec)	53.5 gpd/ft^2 (25.3 cm/sec)
35	85	242	514	528
70	171	483	1029	1056
105	256	725	1543	1584
140	341	967	2058	2113

---

[a] See conversion chart for conversion to metric equivalent.

TABLE 5-5

PROJECTED DRAWDOWNS AT VARIOUS DISTANCES FROM PIT

Thickness of Water Bearing Strata (feet)[a]	Distance from Mine Cut (feet)	Drawdown (feet) for Various Permeabilities (cm/sec)		
		0.66×10^{-4}	2.5×10^{-4}	25.3×10^{-4}
5	50	117	130	134
	100	97	123	131
	250	37	102	121
	500	0	66	105
	1000	0	0	72
	2000	0	0	7
20	50	111	124	129
	100	92	116	124
	250	35	96	115
	500	0	63	99
	1000	0	0	68
	2000	0	0	7
35	50	105	119	126
	100	87	110	120
	250	33	91	108
	500	0	59	94
	1000	0	0	65
	2000	0	0	6

[a] See conversion chart for conversion to metric equivalent.

dust suppression water will be provided by mine dewatering sumps, sedimentation ponds, or untreated well water. In all cases, the volume of water used will be minimal in relation to impacts on ground-water quantity or surface water flow. The only public supply wells in the vicinity are those for the town of Mansfield and those that supply the Rambin Water System. The Mansfield wells are approximately 11.3 kilometers (7 miles) from the permit boundary and are completed into the Naborton Formation updip of the permit area. The wells for the Rambin system are completed into the Dolet Hills Formation approximately 4 kilometers (2.5 miles) from the permit boundary and well beyond the extent of influence as depicted in Table 5-4.

Dewatering or depressurizing the Dolet Hills will have negligible impact on the ground water in the underlying Naborton. Although the Naborton is under artesian pressure, as evidenced by the potentiometric surface of the Naborton, the general low permeability of the sediments underlying the lignite serves to hydraulically separate the Dolet Hills and the Naborton. Where the clays are absent, as in the eastern portion of the site, the level of impact would be greater on the Naborton; however, mining plans call for a more limited extent of mining in these areas. In general, adverse impacts to the ground-water system in the Naborton will be limited to the vicinity of dewatering activity and will be short term, consisting of an increase in the head differentials between the Naborton and the overlying Dolet Hills and a slight increase in potential upwards leakage.

Selective Placement of Materials (DHMV's Preferred Alternative). As a result of mining operations, the mixed cast overburden material will be subject to oxidation processes, thereby adversely impacting water quality within the resaturated material. The exposure of several of the occurring mineral assemblages to oxidation will result in their alteration and partial dissolution when contacted by surface water runoff or infiltration. The concentration of the dissolved ion species, or leachate, at any particular place or time will depend upon the following variables: rate, volume, and chemical nature of the water recharging the system; chemical nature of the cast overburden; and duration of contact of recharge water with the altered cast overburden material.

The material that lies below the water table exists under chemically reducing, or anaerobic conditions. Once the water table is lowered by dewatering, and the overburden is excavated and replaced as spoil, the material is exposed to the atmosphere and to oxidizing agents. In this new environment, specific mineral species are susceptible to chemical alteration to a leachable form. Two parameters of concern with respect to postmine ground-water quality are acidity or toxicity and total dissolved solids. High acidity may create toxic conditions by mobilizing such heavy metal ions as arsenic, manganese, selenium, cadmium, chromium, copper, lead, mercury, nickel, zinc, and vanadium. The most significant constituents likely to contribute to high total dissolved solids are chloride and sulfate. Water having a chloride concentration exceeding the recommended U.S. Public Health Service established standards of 250 parts per million (ppm) may have a salty taste, and sulfate in excess of the recommended 250 ppm may produce a laxative affect. Chloride and sulfate, however, pose no threat to health.

Toxic-forming materials are defined as earth materials or wastes which, when acted upon by air, water, weathering, or microbiological processes, are likely to produce chemical or physical conditions in the soil or water that are detrimental to organisms or to water use. The toxicity of mine overburden associated with the production of acid-mine drainage results primarily, though not exclusively, from the oxidation of iron disulfides contained in the material. It is assumed that such oxidation is not presently occurring in the equilibrated (or steady-state) geochemical system of the project area. Once dewatering and mining begin, large amounts of earth material will be exposed to the atmosphere. It is at this point that the potential for the formation of acid-mine drainage is greatest.

An analysis of overburden was conducted to examine the acid-forming potential of the material (see Appendix C). The procedure utilized for this evaluation is acid-base accounting. The accounting consists of two measurements: 1) total or pyritic sulfur and 2) the neutralization potential. This procedure balances maximum potential acidity (as equivalents of pyritic sulfur) against total neutralizers (as equivalents of calcium carbonates). The use of pyritic sulfur is suggested, as opposed to total sulfur, because the organic and sulfate forms of sulfur are not significant contributors to acid production. Potentially toxic material is defined as material having a net potential deficiency of 5.0 tons or more of calcium carbonate equivalent per 1000 tons of material. In addition, materials having a pH of less than 4.0 are defined as being acid-toxic (Sobek et al., 1978). The acid-base potential compiled in Appendix C, Tables 1, 5 and 7, indicates the results of the accounting procedure conducted. A deficiency of neutralizing material (or potential acid-forming conditions) is noted as a negative number, while an excess of neutralizers is shown as a positive number. Analysis of this data indicates sufficient neutralizing material available in Cores 1, 2, 3, 4, 5, and 11 of Table 1 and Cores 1, 2, 4, 5, and 8 of Table 5 to counteract any acid which may be produced. Several cores reflect a deficiency in neutralizers to balance the potential acidity (as in Cores 6, 7, 8, 9 and 10 of Table 1 and

Cores 3 and 6 of Table 5), however, the net deficiency exceeds 5.0 tons (indicated in the tables as less than or equal to -5) in only a few zones of the cores. These include Table 1: Core 6, 91.9-118.5 feet depth; Core 7, 100.9-104.0 feet depth; Core 8, 25.0-31.7 feet and 59.8-102.1 feet depths; Core 9, 65.5-76.3 feet depth; Core 10, 27.5-46.9 feet, 67.3-84.9 feet and 112.5-128.7 feet depths, and Table 5: Core 3, 50.0-61.0 feet depth; and Core 6, 29.0-37.5 feet and 44.0-52.5 feet depths.

From the acid-base account it is apparent that mixed overburden at the project area possesses inadequate amounts of neutralizers to fully counteract production of acid drainage, although the levels of the potential acidity are indicated to be quite low in general and should be innocuous. It should be noted that investigations of ground-water quality in 25-year-old mine spoil of a Central Texas lignite mine situated in a similar geologic and hydrogeologic environment to that of the Dolet Hills permit area, showed that mine-spoil ground water is similar in quality to that in the pre-mine overburden, and that the formation of toxic leachate did not occur (Matthewson, 1982).

Any leachate which develops will have the potential to flow from the mine in a down-gradient direction (southerly) into adjacent ground-water-bearing strata once the water table is reestablished. Typically, the peak concentrations of leachate occur in the first pore volume of water contained in the leachate generating materials. Subsequent pore volumes generally have lower concentrations, therefore, the maximum potential impact will exist during the time period when the initial pore volume is emanating from the spoil material. The length of this time period is dependent upon the permeability, porosity, and the hydraulic gradient of the spoil.

The concentrations in any plume of leachate will decrease with distance from the mined area and will be dependent upon ground-water velocity, the physical processes of mechanical dispersion, and dilution by recharge to the system. The formation and migration of any leachate plume is expected to attain steady-state conditions, and the edge of any steady-state plume should be within one-half mile down-gradient of the area of mining, based upon investigations and observations of the dispersion characteristics associated with ground-water flow in hydrologically comparable material (Partridge, 1982). However, it is anticipated that concentrations which may exceed water-quality standards will be limited to within a few hundred feet down-gradient of the mine. Therefore, it is anticipated that long-term, adverse impacts to the ground-water resulting from the operation of the mine will occur after the reestablishment of the water table but will be minimal, limited to the mined area and near vicinity adjacent to and downgradient of the mined material. The generally poor quality of the Naborton Formation within the permit area may preclude its use as drinking water and alternative water supplies may have to be provided by DHMV to those users affected. There exist several alternative sources of water to users in the mine area. Pipeline systems currently bring water into the Dolet Hills area from both surface water (Toledo Bend Reservoir) and ground-water supply sources which lie well beyond the extent of impact from the mining (EH&A, 1980a).

Any water bearing units below the Naborton Formation exist under confined conditions and are protected by the relatively impermeable clays of the Porters Creek Formation. Mining activities will have no adverse impact upon deeper aquifers in the region.

Topsoil Segregation and Replacement/No Selective Placement. Impacts of mining and reclamation on ground-water hydrology and water quality will not vary appreciably depending upon the overburden handling technique selected. Similar adverse impacts (as described for the selective placement alternative in Section 5.2.1.4) to the ground-water quality of the area will result from the topsoil segregation or no selective placement alternatives since all three involve exposing unoxidized overburden to the air. The potential to form acidic conditions and heavy metal concentrations are sufficiently low in the overburden to preclude the mobilizaton of toxic levels of heavy metals in postmining ground water. The constituents likely to contribute to high dissolved solids are chloride and sulfate, however, these parameters are not considered by the U.S. Public Health Service to be potentially toxic or a threat to health.

Resaturation of the overburden for the topsoil segregation and the no selective placement alternative will follow the same scenario as for the applicants' preferred selective placement alternative. Postmine recharge will be slightly reduced, horizontal permeabilities will be reduced, and recovery of the ground-water table should take a minimum of ten years (see Section 5.2.1.4). Once ground-water levels have returned to premining conditions, the potential yeild should be comparable to the premining normal rate of use.

5.2.1.5 Combined Impacts of Power Plant and Mine

Impacts of construction activities associated with the power plant will consist of the disturbance of the unsaturated zone of a relatively small area and essentially will impact only the surface recharge or infiltration characteristics in that area. The principal combined impacts on the ground-water system will be a local lowering of water levels adjacent to the mined areas due to dewatering activities in the active mine areas, and a slight recharge of ground water in the vicinity of the power plant's makeup water pond. An estimated 10 years may be required for the cast overburden to become resaturated and reestablish the premine ground-water table. Ground-water quality will be subjected to adverse impacts as the cast overburden material is resaturated. Impacts will be limited to the area of the mining activities and near vicinity down-gradient of mining. If any users of ground water are subjected to contaminated, diminished, or interrupted supplies as a result of the mining activities, DHMV will replace the affected supplies with suitable alternative sources in accordance with LOCSMD regulations. Power plant operations will have no adverse impacts to ground-water quality.

5.2.2 Surface Water

5.2.2.1 Existing Environment

Detailed discussions of surface-water hydrology and water quality investigations for the proposed Dolet Hills Lignite Mine Project are presented in the reports "Surface-Water Hydrology of the Dolet Hills Project" (EH&A, 1981a) and "Steady-State Water Quality of Dolet Hills Project (SWEPCO, 1981). Based on these reports, the following sections describe the hydrology and quality of surface waters in the proposed permit and surrounding study area under existing conditions.

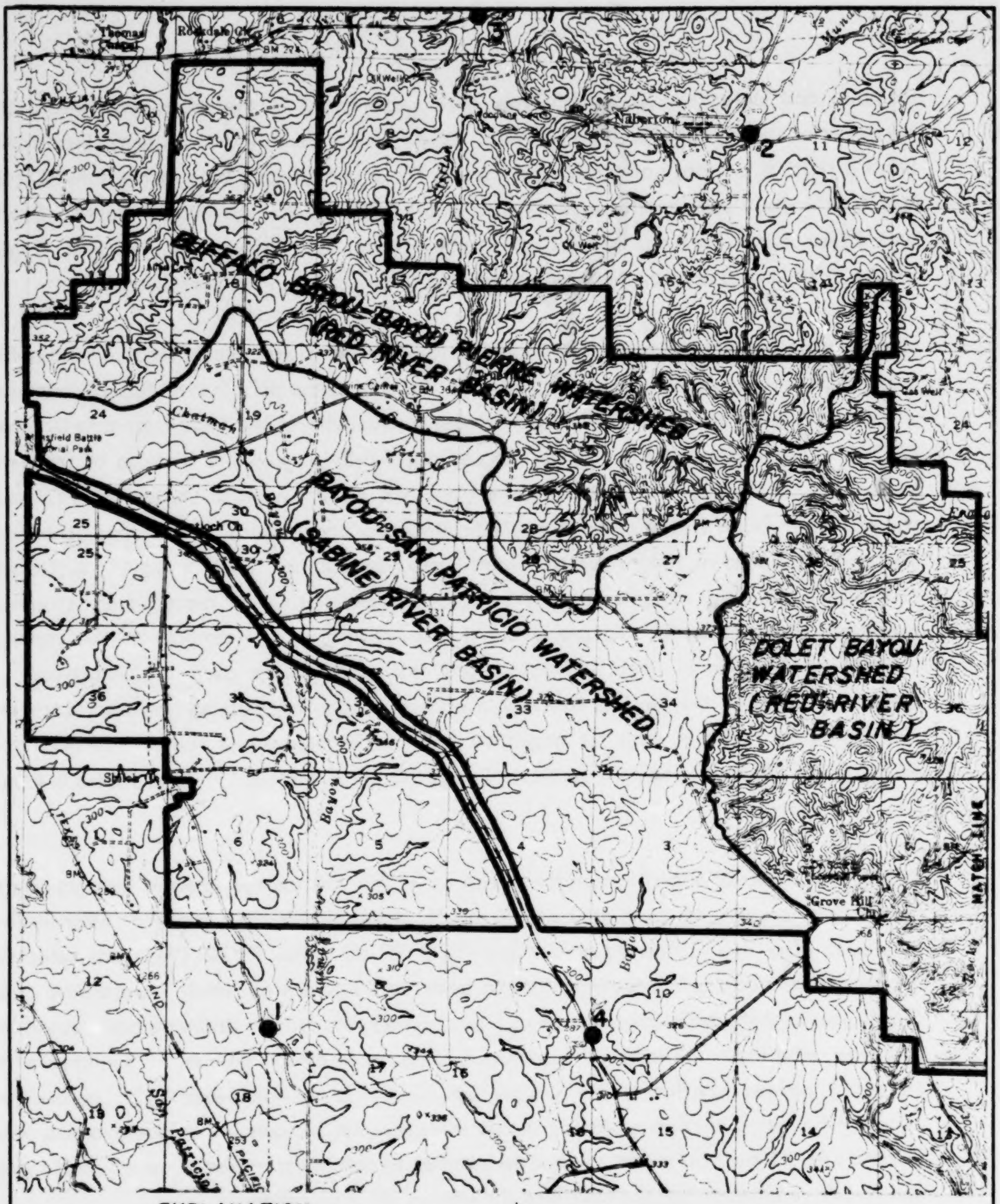
Approximately 69 percent of the proposed Dolet Hills Lignite Mine Project permit area is located within the Red River Basin, while the remaining 31 percent is located within the Sabine River Basin. Streams within the Red River Basin flow generally in a northerly, northeasterly or easterly direction, while Sabine River tributaries flow in a southerly direction. The streams within the permit area are classified as either intermittent (seasonally dry) or ephemeral (sustained only by storm runoff). Several of the on-site streams drain to Dolet Bayou, a perennial stream located to the east of the permit area boundary.

The headwaters of most of the local streams are located within the permit area boundary. These watersheds include Fourmile, Fivemile, Tenmile, Chatman, Clifton, Mundy, and Bailey bayous. Other watersheds that originate adjacent to the permit area are Wallace, Rambin, and Dolet bayous, which have their headwaters to the south, southwest, and northeast of the permit area, respectively. Chatman and Tenmile bayous drain into Bayou San Patricio, a tributary of the Sabine River. The other streams flow either into Buffalo Bayou or Bayou Pierre to the north or into Dolet Bayou to the southeast. Buffalo Bayou and Dolet Bayou are tributaries of Bayou Pierre, a tributary of the Red River. Figure 5-3(a and b) depicts the major watershed delineations in the permit area.

Hydrologic Characteristics. Only one recording streamflow gage is located within the immediate vicinity of the proposed project . The U.S. Geological Survey (USGS) installed a gage on Chemard Lake at the LA 177 bridge, downstream of the permit area, in October 1977. As discharges could not be determined accurately at this site because of frequent backwater conditions, the Chemard Lake gage was discontinued in September 1979 and reinstalled on Dolet Bayou at the LA 177 bridge, near the eastern permit area boundary. The current period of record for the Dolet Bayou gage is too short to provide sufficient streamflow data to indicate the hydrologic characteristics of permit-area streams. However, streamflow records are available for several other streams in the general vicinity of the permit area. These gaged watersheds were used as prototypes to determine some of the general hydrologic characteristics of regional streams. Streamflow and flow duration data for gaged streams in the vicinity of the permit area are presented in the Dolet Hills Power Plant Project Draft EIS (EPA, 1981), as Tables 4-4 and 4-5, respectively.

Due to the lack of gaged streamflow records within the permit area, a mathematical model was chosen to predict rainfall-runoff relationships for baseline information purposes. The Soil Conservation Service (SCS) TR-20 model (SCS, 1965) was selected because of its accuracy in predicting flood peaks and volumes for small watersheds. The model uses a systematic approach to develop hydrographs from a drainage basin based on soil type, land use, main-channel length and slope, and rainfall amounts associated with storms of various durations and return periods. A 386-square-kilometer (149-square-mile) hydrologic study area, encompassing the permit area and surrounding adjacent areas, was divided into 70 sub-basins and 36 channel reaches to obtain estimates of peak runoff rates and runoff volumes at various locations throughout the study area.

Soils are assigned hydrologic group classifications by the SCS based on runoff potential. Hydrologic Group A represents the lowest runoff potential (highest infiltration capacity) followed by Groups B, C, and D. The hydrologic classification of each soil association in


BUFFALO BAYOU-BAYOU PIERRE WATERSHED
(RED RIVER BASIN)
BAYOU SAN PATRICIO WATERSHED
(SABINE RIVER BASIN)
DOLET BAYOU
WATERSHED
(RED RIVER
BASIN)
1
2
3
4
Naborton
Grove Hill
Chatman
Rockdale Ch
Thomas Chapel
MATCH LINE

EXPLANATION

PERMIT AREA BOUNDARY

MAJOR WATERSHED DIVIDE

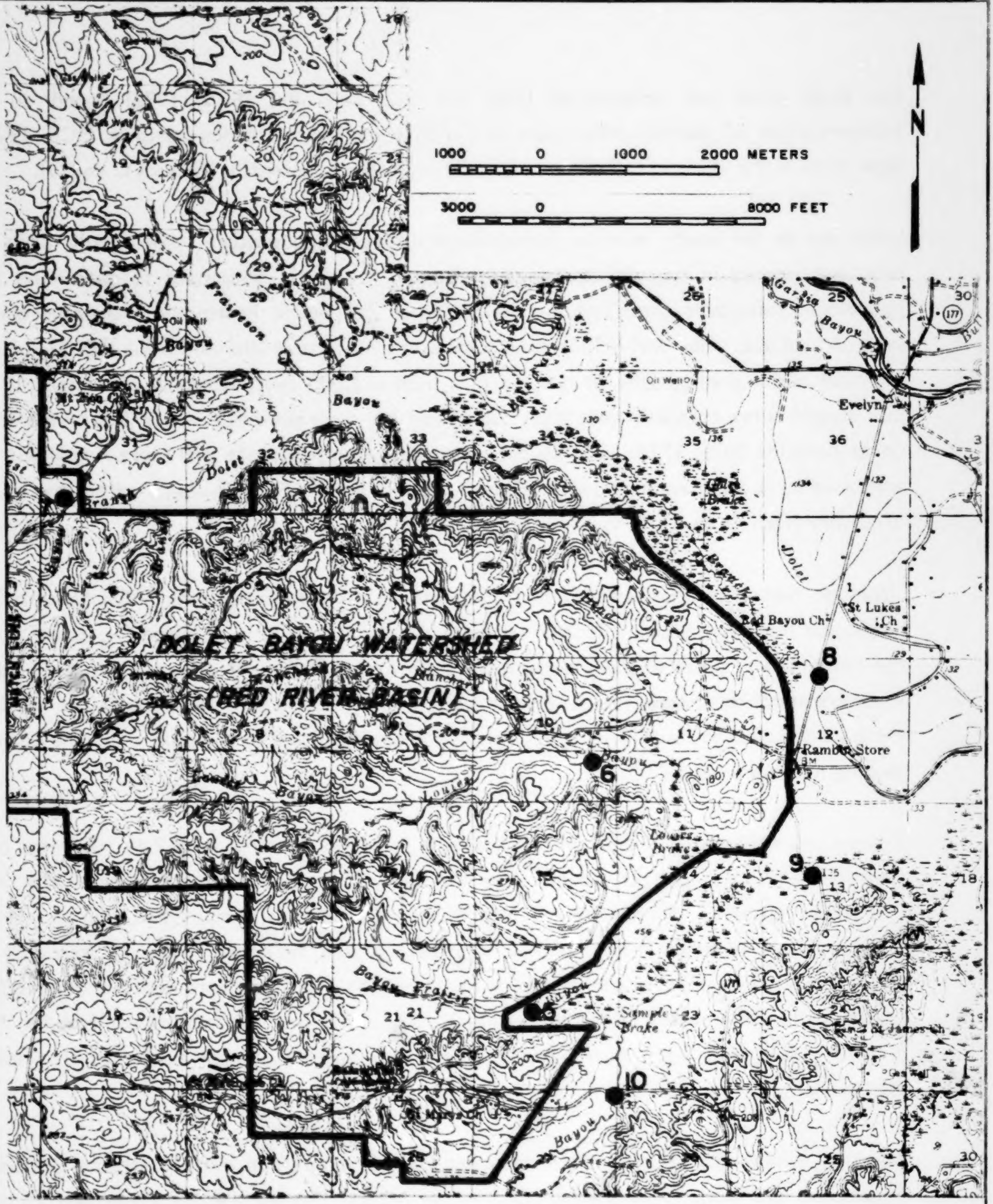
8 ● WATER QUALITY SAMPLING STATION

1000 0 1000 2000 METERS

3000 0 8000 FEET

N

FIGURE 5-3a
MAJOR WATERSHEDS AND WATER QUALITY SAMPLING STATIONS, DOLET HILLS LIGNITE PROJECT
West Area
SOURCE: EHBA


N
1000 0 1000 2000 METERS
3000 0 8000 FEET
DOLET BAYOU WATERSHED
(RED RIVER BASIN)
Garcia Bayou
Evelyn
Bayou
Dolet
Branch
Fraizeson
Red Bayou Ch
St Lukes Ch
Rambin Store
Louise
Bayou Fraizer
Sample Brake
St Marys Ch
8
6
9
10

EXPLANATION

▬ PERMIT AREA BOUNDARY

— MAJOR WATERSHED DIVIDE

8● WATER QUALITY SAMPLING STATION

FIGURE 5-3b
MAJOR WATERSHEDS AND WATER QUALITY SAMPLING STATIONS, DOLET HILLS LIGNITE PROJECT
East Area
SOURCE: EHBA

the study area was determined from the SCS soils list (SCS, 1972) based on an interpretation of general soils maps of De Soto and Natchitoches parishes (SCS, 1971). Most soils in the study area have a relatively high runoff potential (Groups C and D).

Land use in the study area is predominately forest and pasture, with small areas of cropland located in the vicinity of Dolet Bayou. Land-use data used to determine the hydrologic soil-cover complex, a combination of a specific hydrologic soil group and a type of land use, were derived for each sub-basin by interpretation of NASA RB-57, color-infrared aerial photography at a scale of 1 inch = 2,000 feet, flown in November 1974. SCS runoff curve numbers were then calculated for each sub-basin according to the soil-cover complex (SCS, 1972). Higher curve number values indicate that more runoff will be produced for a given rainfall depth. Runoff curve numbers for sub-basins within the study area vary from 71 to 83 (EH&A, 1981a).

Drainage areas, channel lengths, and gradients were determined from USGS topographic maps, and the time of concentration for each sub-basin (the time required for runoff from the most remote point in the sub-basin to reach the sub-basin outlet) was calculated using Kirpich's equation (Chow, 1964). Reach lengths of the main stream channels are used in the runoff model to route hydrographs from one control point to the next using the convex routing method (SCS, 1972).

Twelve separate storm events with recurrence intervals ranging from 2 to 100 years and durations of 6, 12, and 24 hours, were selected for analysis in connection with the hydrologic studies. Point rainfall depths for the various frequencies and durations analyzed were obtained from the U. S. Weather Service Technical Paper 40 (Hershfield, 1961) and were reduced to correspond to the total drainage area considered in the model, or 386 square kilometers (149 square miles). The time distributions of rainfall for the durations analyzed were based on standard SCS and U.S. Army Corps of Engineers distributions.

Detailed summaries of peak discharges and runoff volumes at various stream locations throughout the study area are included in the report, "Surface-Water Hydrology of the Dolet Hills Project" (EH&A, 1981a). Computed ranges of peak discharge and runoff volume per unit area for individual sub-basins in the study area, as determined from the hydrologic modeling, are tabulated in Table 5-6 for the various storm recurrence intervals analyzed. The wide range in peak unit runoff rates reflects the varying physical, topographic, and hydrologic characteristics of the watersheds in the study area. In general, high runoff curve numbers coupled with short times of concentration result in the highest peak discharges per unit area. Peak discharges are also higher for the shorter, more intense storms occurring over individual sub-basins. As a result of relatively impermeable soils and steep channel gradients in the headwater sub-basins, these streams exhibit a rapid runoff response with high peak discharge rates but little or no base flow. Lower peak discharges per unit area and longer periods of substained flow are characteristic of the lower reaches of Chemard Lake and Dolet Bayou, east of the permit area, due to the flatter topography.

Water Quality. With the exception of limited USGS water-quality sampling on Bayou Pierre, West Branch Dolet Bayou, and Chemard Lake, published water quality data are not generally available for local streams in the immediate permit area of the proposed Dolet Hills Lignite Mine Project. Due to the lack of sufficient site-specific water quality data, SWEPCO conducted a one-year monitoring program at ten locations on streams in the vicinity of the proposed permit area (SWEPCO, 1981). The water quality monitoring program consisted of monthly sampling during the period May 1979 through April 1980 and analyses for a number of physical, chemical, and biochemical parameters as noted in Table 5-7. The locations of the water-quality sampling stations are listed in Table 5-8 and are shown in Figure 5-3(a and b).

Mean and extreme values for several water quality parameters as determined from SWEPCO's monitoring program are given in Table 5-9. In general, the water quality of the permit-area streams was found to be relatively good. Concentrations of chlorides, sulfates, and total dissolved solids remained within the limits of the State of Louisiana water-quality standards throughout the one-year monitoring period, and pH values remained within the specified range. Depressed levels of dissolved oxygen were noted during summer months, corresponding to periods of low streamflow and high temperature. Fecal coliform and nutrient levels were high at some of the monitoring sites during periods of storm runoff. Concentrations of the measured constituents varied throughout the duration of the monitoring program, with higher levels of some constituents noted during low flow periods due to concentration and during high flow periods due to flushing and leaching. Iron and manganese concentrations were relatively high, occasionally exceeding the EPA and LDNR effluent limitations for new source mine area discharges. The presence of these metals may be attributed to the geologic conditions in combination with natural leaching and concentration in the streams. Details of the surface water-

TABLE 5-6

RANGES OF PEAK DISCHARGE AND RUNOFF VOLUMES PER UNIT AREA FOR SUB-BASINS WITHIN THE STUDY AREA

Recurrence Interval (years)	Peak Discharge Per Unit Area (csm)	24-Hour Storm Runoff Volume (inches)a
2	125-816	1.7-2.6
10	256-1,263	3.6-4.9
25	321-1,418	4.7-6.1
50	371-1,690	5.5-6.9
100	427-2,091	6.4-7.9

a. See Conversion Chart for conversion to metric equivalent.
Source: EH&A, 1981a.

TABLE 5-7
PARAMETERS ANALYZED IN DOLET HILLS WATER QUALITY MONITORING PROGRAM
(MAY 1979 - APRIL 1980)

Temperature (°C)
Dissolved Oxygen
pH (Field)
pH (Lab, @ 25°C)
Color (Standard units)
Conductivity (Field, micromhos/cm)
Conductivity (Lab, micromhos/cm)
Turbidity (NTU)
Alkalinity (as $CaCO_3$)
Hardness (as $CaCO_3$)
Total Suspended Solids
Total Dissolved Solids
Total Residue
Biochemical Oxygen Demand

Chemical Oxygen Demand
Ammonia - nitrogen
Nitrate - nitrogen
Nitrite - nitrogen
Organic - nitrogen
Total phosphorus
Dissolved Orthophosphate - phosphorus
Sulfate
Chloride
Fluoride
Oil and Grease
Silica
Fecal Coliform (#/100ml)

Metal Analyses

Aluminum
Arsenic
Beryllium
Boron
Cadmium
Calcium
Chromium
Copper
Iron
Lead

Magnesium
Manganese
Mercury
Molybdenum
Nickel
Potassium
Sodium
Strontium
Zinc
Selenium

Metal analyses were conducted bi-monthly, with all other analyses conducted monthly.

All units are mg/l unless noted otherwise.

Source: EH&A, 1981a.

TABLE 5-8
WATER-QUALITY SAMPLING SITES[a]
DOLET HILLS WATER QUALITY MONITORING PROGRAM
(MAY 1979 - APRIL 1980)

Sampling Site No.	Stream	Location
1	Chatman Bayou	Parish road north of Oxford, above confluence with Bayou San Patricio.
2	Mundy Bayou	Parish road immediately east of Naborton, above confluence with Buffalo Bayou.
3	Clifton Bayou	U.S. 84 bridge, northwest of Naborton.
4	Tenmile Bayou	LA 175 bridge, south of Mansfield.
5	Prairie Bayou	Parish road above confluence with Sample Brake.
6	Louies Bayou[a]	Parish road west of Rambin Store, below confluence with Blanchard Bayou.
7	West Branch[a] Dolet Bayou (upper site)	Parish road northeast of DeSoto lookout tower and Grove Hill Church, immediately above confluence with Rocky Bayou.
8	West Branch Dolet Bayou (lower site)	LA 177 bridge, north of Rambin Store.
9	Chemard Lake[b]	LA 177 bridge, south of Rambin Store.
10	Rambin Bayou	LA 346 bridge, upstream of confluence with Sample Brake.

a. See Figure 5-3 (a and b) for sampling locations.

b. Inside permit area.

Source: EH&A, 1981a.

TABLE 5-9
MEAN AND EXTREME VALUES FOR SELECTED WATER-QUALITY PARAMETERS
DOLET HILLS WATER-QUALITY MONITORING PROGRAM
(MAY 1979 - APRIL 1980)

Monitoring Site	Conductivity (micromhos/cm)	pH	Dissolved Oxygen (mg/L)	Fecal Coliform (#/100ml)	Total Dissolved Solids (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Total Suspended Solids (mg/L)	Total Iron (mg/L)	Total Manganese (mg/L)
(1) Chatman Bayou	72 (40-110)	- (5.8-7.8)	7.6 (1.1-11.8)	193 (0-1,450)	109 (60-202)	20 (6-42)	7 (3-12)	13 (2-25)	4.2 (1.0-13.0)	0.74 (0.02-1.80)
(2) Mundy Bayou	108 (65-150)	- (6.9-7.6)	7.9 (4.2-11.0)	194 (20-1,150)	134 (88-218)	21 (8-39)	22 (7-42)	19 (2-74)	3.7 (2.2-8.0)	0.28 (0.05-1.26)
(3) Clifton Bayou	162 (75-275)	- (6.9-7.8)	6.6 (1.6-12.0)	514 (<20-2,350)	160 (84-218)	28 (10-58)	17 (5-42)	9 (<1-26)	2.3 (1.0-7.8)	0.72 (0.10-1.90)
(4) Tenmile Bayou	56 (30-110)	- (6.4-8.4)	6.8 (0.6-10.6)	2,318 (0-24,800)	93 (52-156)	13 (3-26)	6 (3-14)	9 (1-26)	3.9 (0.5-17.8)	0.88 (0.02-4.60)
(5) Prairie Bayou	104 (50-175)	- (6.9-7.8)	8.7 (2.0-11.8)	499 (40-2,100)	124 (52-194)	19 (8-32)	17 (9-24)	15 (3-50)	3.5 (2.0-8.7)	0.17 (0.02-0.60)
(6) Louies Bayou	81 (50-120)	- (6.7-7.8)	8.2 (3.0-12.2)	239 (20-1,420)	105 (74-144)	25 (10-54)	6 (3-9)	15 (3-27)	3.5 (1.6-10.6)	0.10 (0.02-0.30)
(7) West Branch Dolet Bayou (upper site)	49 (35-60)	- (7.1-7.9)	10.0 (7.6-12.0)	198 (<20-520)	76 (56-160)	12 (4-24)	7 (3-9)	9 (<1-24)	1.7 (0.9-3.4)	0.06 (0.02-0.10)
(8) West Branch Dolet Bayou (lower site)	150 (60-340)	- (6.7-7.8)	7.3 (3.8-14.0)	544 (40-1,780)	158 (80-236)	33 (10-72)	13 (5-29)	21 (4-67)	2.7 (1.1-8.1)	0.58 (0.02-3.00)
(9) Chemard Lake	131 (55-225)	- (6.8-7.5)	6.7 (2.9-9.8)	126 (10-460)	126 (72-216)	24 (9-42)	14 (2-38)	8 (1-20)	2.5 (1.0-4.4)	0.74 (0.10-3.70)
(10) Rambin Bayou	205 (110-320)	- (6.8-7.5)	7.0 (0.8-11.2)	85 (0-220)	199 (130-274)	24 (10-44)	32 (4-68)	13 (4-18)	2.2 (1.0-5.2)	0.40 (0.05-1.60)

Samples collected on: 5-3-79 8-8-79 11-1-79 2-6-80
6-13-79 9-5-79 12-5-79 3-5-80
7-5-79 10-10-79 1-9-80 4-16-80

Source: SWEPCO, 1981.

quality monitoring program, including tabulated results for all constituents analyzed and discussions for each monitoring site, are included in the report, "Steady-State Water Quality of the Dolet Hills Project" (SWEPCO, 1981).

5.2.2.2 Effects of No Action

The no action alternative would eliminate the adverse impacts of construction and operation related to the proposed Dolet Hills Lignite Mine Project. In the absence of the project, the surface water regime of the project area should remain essentially unchanged from existing conditions, barring the possibility that other independent development may occur in the vicinity.

5.2.2.3 Construction Impacts

Hydrologic Conditions. Activities related to mine construction will result in some short-term impacts on the surface water hydrologic regime on and adjacent to the mine site. Excavation and grading activities associated with the construction of overland flow diversion facilities, sedimentation ponds, and other erosion control measures to be implemented prior to mining, in accordance with LDNR surface mining regulations, will alter existing drainage patterns, overland runoff volumes, peak runoff rates, and sediment loadings. Also affecting the hydrologic characteristics of the site will be other activities associated with development of the mine facility, including timber and brush clearing, road relocation and construction, pipeline relocation, construction of stream diversions, and site preparation and construction of shop facilities. These operations will result in temporary reductions of streamflow in some localized areas (e.g., below stream diversions), while runoff will increase at other locations such as temporarily denuded areas and streams receiving diverted runoff from other areas. Channelization of overland flow at construction sites will also tend to increase localized peak runoff rates in the affected areas. Construction impacts on runoff characteristics will be of short-term duration, essentially ceasing upon the completion of the facilities and revegetation of the affected areas. The stream reroutes planned will generally consist of diversions into parallel channels to allow the recovery of lignite in the original channel locations. Approximately 15.9 kilometers (9.9 miles) of streams within the permit area will be temporarily diverted; another approximately 10.8 kilometers (6.7 miles) will be permanently diverted. Approximately 4.5 kilometers (2.8 miles) of these diverted streams will be constructed outside the area to be mined. Within the mining blocks, flow to the existing stream will be left unimpeded until the parallel diversion is constructed. Existing streams will be temporarily and adversely affected by runoff and increased sediment loading during construction. After completion of a temporary stream diversion, flow will be directed to the new channel and the existing streambed will be mined, thus resulting in the direct adverse impact of total removal. Once the overburden has been replaced, the streambed will be replaced and flow from the diversion will be directed back to the site of the original streambed. Permanent diversion activities will be conducted in the same manner except that the original streambed will not be replaced and thus will be adversely affected in the long term. However, the parallel diversion will accommodate all watershed runoff that previously flowed through the original stream. As these diversions will be very localized, with the exception of Tenmile Bayou, to be diverted to the Red River Basin for approximately two years, long-term effects on downstream flows are not anticipated. In addition, many of the stream diversions will be temporary, as the stream channels will be restored in their approximate original locations during reclamation. Current technology will be employed, as necessary, to minimize the potential adverse effects of mine construction on runoff (e.g., riprap, energy dissipators, etc.). Therefore, overall adverse effects of mine-related construction activities on the surface water hydrologic regime of the area should be temporary and minor.

Water Quality. Mine development will require construction activities that will have some short-term effects on the surface water quality within and adjacent to the mine site. Activities such as road relocations and construction and site preparation will cause some increases in sediment production. In addition, excavation and grading work in connection with the construction of overland flow diversion facilities and sedimentation ponds is expected to result in short-term increases in sediment production. Areas in which only diversion ditches, sedimentation ponds, or roads are installed prior to mining activities are not subject to compliance with effluent limitations for runoff from disturbed areas. The overall adverse effects of mine-related construction activities on the surface water quality of the area should be minor in magnitude and of short-term duration. Sediment control measures such as mulches, straw dikes, vegetative filters, and detention basins will be implemented, as necessary, to minimize sediment production during the construction phase.

5.2.2.4 Operation Impacts

Hydrologic Conditions. The hydrologic characteristics of the permit area will be subject to continual change as the mining operations progress. Mining activities such as vegetation and overburden removal, lignite extraction, construction and removal of runoff interceptor ditches, sedimentation ponds, stream diversion channels and other surface water control facilities, and reclamation activities will serve to maintain the hydrologic characteristics of the site in a constant state of flux. Among the characteristics that will be subject to change are the areal extent and shape of individual drainage basins, topography, nature and extent of vegetative cover, and soil composition and condition. In addition, the artificial changes in natural runoff patterns induced by surface water control facilities (diversion ditches, stream reroutes, and sedimentation ponds) will result in altered storm runoff response in comparison to existing conditions. Due to the dynamic nature of the mining operation and its affects on the area watersheds with regard to both location and time, the hydrologic impacts of mine-related drainage alterations will generally be temporary in any specific area. Changes in streamflow characteristics of the small local streams in the mine area due to drainage alterations are expected to have only very minor effects, if any, on the flow characteristics of the major downstream receiving streams (i.e., Bayou Pierre and Bayou San Patricio).

Runoff volumes from the mine site will be temporarily increased as the land is prepared for mining. However, contributions to peak discharges downstream of these areas will actually be decreased as a result of the impoundment of runoff from disturbed areas in sedimentation ponds, which will be constructed in accordance with LOCSMD regulations. Although the sedimentation ponds will substantially reduce flood peaks at their points of discharge from the mine site into the Bayou Pierre and Bayou San Patricio watersheds, particularly during smaller storms, the effects upon the flood peaks of the major receiving streams downstream of the project area will be very minor as a result of the differences in drainage areas and lag times between the receiving streams and the local tributaries within the mine area. Discharges from sedimentation ponds will tend to sustain downstream flows for longer periods following storms, as will the collection and pumpage of precipitation falling on active pit areas. The attenuation of flood peaks and maintenance of sustained flows for longer periods following a storm are generally regarded as beneficial impacts to the hydrologic regime.

The baseflow components of streams that are fed by springs and seeps (e.g., West Branch Dolet Bayou) may be diminished to some degree as a result of the mining operations, which will unavoidably disrupt the shallow aquifer. However, as noted in Section 5.2.2.1, most of the local streams in the project area are classified as intermittent or ephemeral, and thus exhibit no significant baseflow. Therefore, the adverse impacts of mining on the low flow and flow-duration characteristics of area streams should be minor. In certain instances, mine-related surface water control operations, (e.g., controlled releases from sedimentation ponds, pit pumpage) may augment the low flows of some streams, resulting in more sustained low flow characteristics than under existing conditions.

As the mined areas are reclaimed, hydrologic characteristics will gradually approach premining conditions. Sedimentation ponds will be maintained until runoff from the reclaimed areas is of sufficient quality to allow removal of the ponds. Hence, the effects of sedimentation ponds on downstream flow characteristics discussed previously (lower flood peaks and longer sustained flows following storms) will also be experienced to some degree during reclamation. Additionally, some sedimentation ponds will remain in place permanently following reclamation, if compatible with the intended postmining land use.

Postmining runoff characteristics of the reclaimed lands are expected to change from premining conditions as a result of permanent and temporary stream diversions and changes in land use with differences in vegetation and soil characteristics. Effects of temporary diversions will be short term as the existing streambed will be reestablished. The effects on streams permanently diverted will be long term and irreversible; however, the parallel permanent diversions will accommodate all watershed runoff that previously flowed through the original stream. The planned permanent and temporary stream diversions are shown on Figure 4-7 in Section 4.4.4.6. If any users of surface water are subjected to contaminated, diminished, or interrupted supplies as a result of the mining activities, DHMV will replace the affected supplies with suitable alternative sources in accordance with LOCSMD regulations. Impacts of mining and reclamation on surface water runoff characteristics will vary somewhat depending upon the overburden handling technique selected. If topsoil is replaced, runoff quantities are not expected to change appreciably from existing (premining) conditions. However, it is noted that, even with topsoil replacement, the premining spatial distributions of soils cannot be duplicated exactly, and some localized changes in runoff characteristics are to be expected in comparison with premining conditions. If the reclamation scheme involves selective placement of overburden (DHMV's preferred alternative) or a total overburden mix as the postmining surface soil, runoff potential may increase in some areas and decrease in others in comparison with premining conditions.

Water Quality. The impacts of the proposed mining activities upon the water quality of the receiving streams will reflect the spatial and temporal progression of the mining activities, the nature of the effluents generated, and the treatment methods employed. All effluent sources associated with the mining operations will be subject to applicable State and Federal effluent limitations and water-quality standards.

Potential surface water-quality impacts resulting from the mining operations will arise from several sources. Surface runoff from disturbed areas, which will be collected and treated in sedimentation ponds, will comprise one source of effluent. The sedimentation ponds will be designed in accordance with LOCSMD regulations to control the runoff resulting from a 10-year, 24-hour storm, with discharges from the ponds being subject to new source performance standards (NSPS) for total suspended solids, total iron, total manganese, and pH (Table 5-10). Locations of point source discharges from sedimentation ponds (Figure 4-7 a and b) will vary throughout the life of the mine as the mining operations progress, with such discharges occurring in each of the major project-area watersheds at some point in time. Waters from mine pit dewatering or depressurizing will be pumped to sedimentation ponds and treated as necessary prior to discharge. Periodic, short-term adverse impacts on receiving stream water quality will occur as a result of mining (e.g., increases in sediment load). However, levels of conventional pollutants covered in the NPDES permit for mine runoff (pH, total suspended solids, iron, manganese) will not be exceeded and water quality standards should not be violated.

Selective Placement of Materials (DHMV's Preferred Alternative). Constituents in mine runoff waters which are not covered by the NSPS (e.g., heavy metals) are not expected to result in major water quality problems. As discussed previously in Section 5.2.1.4, a review of available data on acid-base potential compiled in Appendix C indicates a net deficiency in neutralizing material to balance potential acidity in several of the overburden cores, although the net deficiency exceeds five tons of $CaCO_3$ equivalent per 1,000 tons of overburden in only a few zones. Additionally, data presented in Appendix C indicate most heavy metal concentrations to be within acceptable levels insofar as toxicity to plants and animals is concerned, and concentrations are generally no higher in subsurface layers than in surface layers. In localized areas where zones of high potential acidity exist in the overburden (Section 5.2.1.4), mobilization of those heavy metals

TABLE 5-10
EPA NEW SOURCE PERFORMANCE STANDARDS FOR COAL MINE DISCHARGES

Parameter	Daily Maximum	30-Day Average
Iron, total (mg/L)	6.0	3.0
Manganese, total (mg/L)	4.0	2.0
Total Suspended Solids (mg/L)	70.0	35.0
pH Range	6.0-9.0	6.0-9.0

Source: 44 FR 2586-2592.

present may occur, resulting in adverse impacts on runoff water quality. Therefore, although the overburden geochemistry data do not indicate major or widespread instances of adverse water quality impacts, some isolated instances of adverse impacts related to acidity and mobilization of toxic substances are expected to occur in localized areas within the mine area that drain to sedimentation ponds. Compliance with the applicable permit monitoring and reporting requirements for LDNR will provide the means for identifying excessive toxic constituent levels in the effluents, at which time appropriate mitigative action will be taken, if necessary.

Other effluent streams to be generated by the mining activities will include seepage into the active pits, direct rainfall into the active pits, domestic sewage, and vehicle washwaters. Pit seepage and rainfall on the pit areas will be collected in sumps, pumped to collection ponds, treated as necessary, and discharged to appropriate receiving streams. Due to the large areal extent and multiple-pit mining operations, various watercourses will serve as receiving streams for the pit dewatering effluents during the life of the project. The general area to be covered by the NPDES permit is that area to be disturbed during the first 5 years of construction and operation. Figure 4-7a and b shows the locations of sedimentation ponds described in the draft permit (Appendix A). Most are concentrated in the eastern portion of the permit area. Two ponds are located in the northwestern portion, near the main office. All the ponds must comply with limitations for pH, TSS, iron and manganese, and discharges into two of the ponds (001V and 001J) must also comply with more stringent limitations for TSS, and with BOD limitations. The outfalls of these sedimentation ponds will be monitored as indicated in the draft permit (Appendix A). Approximately 8,516 liters (2,250 gallons) per day of domestic sewage will be treated in package treatment facilities and discharged to nearby sedimentation ponds. Vehicle washwaters will be treated as necessary (e.g., oil skimmer) and discharged to sedimentation ponds. Berms will be constructed around fuel supply tanks at the main and field offices to control spillage. In general, as all wastewater sources associated with the mine will be subject to NPDES permit requirements and compliance with applicable water-quality standards, adverse water-quality impacts are expected to be minor.

Under the selective placement alternative, no significant adverse impacts to surface water quality are anticipated, although there exists the possibility that toxic substances could occur on the surface and create surface water quality problems. However, such impacts would be short-term since surficial toxic materials would be buried or removed in order to mitigate any such problems.

Topsoil Segregation and Replacement. As noted previously in this section and in Sections 5.1.3.1 and 5.2.1.4, overburden data (Appendix C) indicate that adverse water quality impacts due to acidity and mobilization of toxic substances should be minor and localized in occurrence. Under the topsoil replacement alternative, any toxic materials present in the overburden should be buried, and detrimental effects on runoff water quality would be unlikely. During active mining (i.e., before topsoil replacement) any exposed acid-forming and toxic materials present in the overburden represent potential sources of water quality problems until they reach sedimentation ponds. This short-term impact would, in most instances (i.e., except for the occurrence of isolated "hot spots") be eliminated during reclamation with the burial or removal of acid-forming and toxic substances.

No Selective Placement. Although long-term adverse impacts on surface water quality are not anticipated under a total overburden mix alternative, the likelihood of acid-forming and toxic materials ending up on the surface is much greater than under the topsoil replacement or selective placement alternatives. If such "hot spots" occur, appropriate mitigative measures (burial or removal) will be implemented as necessary to correct the situation prior to the time the land is released from bond. It is noted, however, that "hot spots" may recur following release from bond if vegetation is not maintained by the landowner and substantial erosion of surface soil occurs. This represents a potential long-term adverse impact to surface water quality. All three overburden handling alternatives will have to comply with the same standards.

5.2.2.5 Combined Impacts of Mine and Power Plant

Hydrologic Conditions. Combined construction and operation impacts of the mine and power plant on the hydrologic characteristics of the area will essentially be additive within areas of common influence (i.e., the Mundy Bayou watershed). Both operations will require timber and brush clearing, resulting in short-term localized increases in peak runoff rates and overland flow runoff volumes. The combined effects of the clearing activities and earthwork involved with the construction and operation of the mine and power plant operations will temporarily increase the potential for erosion and the resultant sediment loadings. This will be a short-term adverse impact. However, the power plant operational impacts will be virtually static throughout the life of the project, while mining impacts will vary continuously with respect to time and location. With regard to areal extent, the power plant construction and operational impacts, with the exception of make-up water withdrawals from Toledo Bend Reservoir and discharges to the Red River, will be confined primarily to the Mundy Bayou watershed in the Red River Basin. However, mine construction and operational impacts will adversely affect various watersheds on a short-term basis in both the Red and Sabine river basins during the life of the project.

Adverse hydrologic impacts will be minimized upon completion of the surface water control facilities. Sedimentation ponds will attenuate flood peaks in addition to their primary function of controlling suspended solids in mine and power plant runoff waters.

Water Quality. Water quality impacts due to construction of the combined mine and power plant should essentially be additive in commonly-affected areas (i.e., the Mundy Bayou watershed) during the period of simultaneous construction activities. Power plant construction impacts on water quality will cease upon completion of the power station and associated facilities, while mine construction impacts (except for initial primary facility construction) will occur at varying locations throughout the life of the project.

Power plant operational impacts will adversely affect only streams in the Red River Basin (i.e., Mundy Bayou in the case of retention pond discharges and the Red River in the case of cooling tower blowdown), while mine operational impacts on water quality will adversely affect various watercourses both temporarily and permanently in both the Red and Sabine River basins, reflecting a progression of the mining and reclamation activities. Additive operational adverse impacts of the mine and power plant on water quality will be experienced during the period of mining within the Mundy Bayou watershed.

5.3 CLIMATOLOGY/AIR QUALITY

5.3.1 Existing Environment

The climatic features considered representative of the proposed Dolet Hills Lignite Mine Project area in northwestern Louisiana have been fully discussed in the Dolet Hills Power Plant Project Draft EIS (EPA, 1981). Some of the data are regionally representative and have been specifically interpreted for the project area. Other data were collected from nearby climatic stations at Shreveport and Natchitoches. Additional technical details, including evaporation and relative humidity information, are provided in a baseline climatology and air quality report for the proposed project area (EH&A, 1981b).

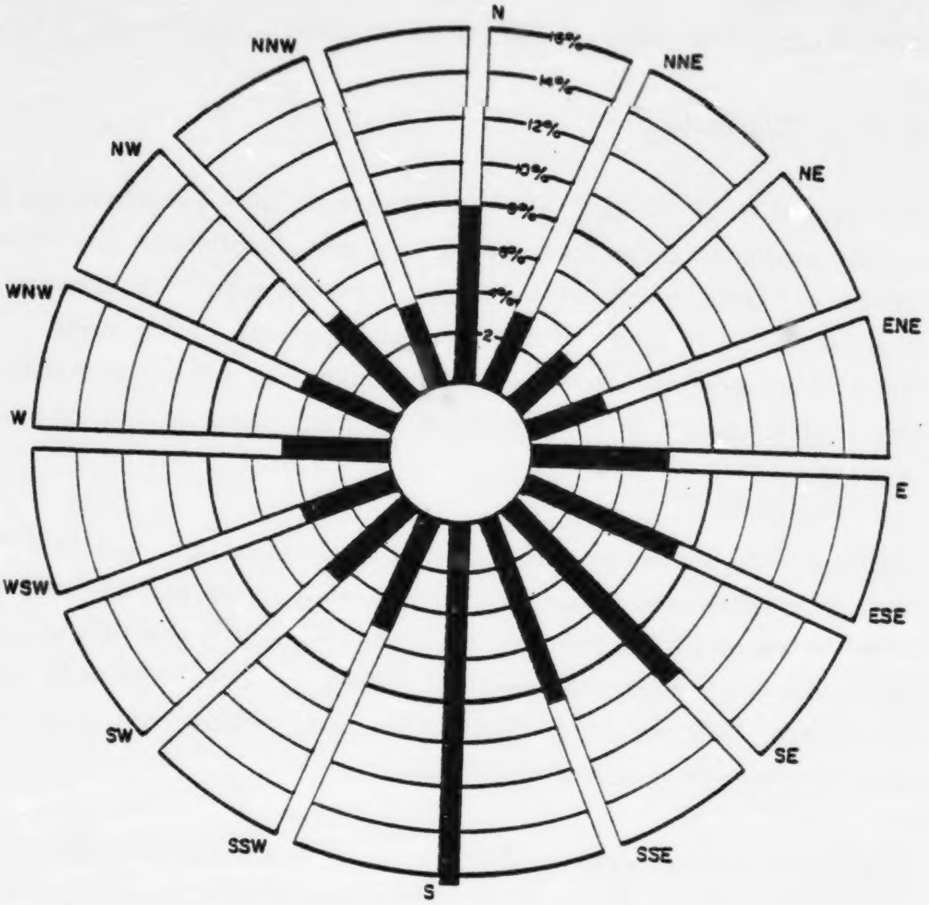
5.3.1.1 Climatology

The proximity of the Gulf of Mexico (approximately 241 kilometers (150 miles) to the south) greatly influences local meteorology and climatology. The climate of the project area is a transition between the primarily humid, subtropical areas to the south and the less humid, continental areas of the plains states to the north. The project area experiences generally warm summers punctuated by occasional thundershowers. Winters are mild to cool, with cold air intrusions every three to five days during the coldest months.

Average daily winter temperatures range from the upper 30's at night to the low 60's during the afternoon. In the summertime, daily temperatures vary from the low 70's at night to the mid-90's during the afternoon. Rainfall is generally abundant in the project area, with nearly all monthly averages exceeding 7.6 centimeters (3 inches) (U.S. Dept. of Commerce, 1976 and 1978). Most of the precipitation, both in quantity and number of occurrences, is from convective showers.

The annual average wind speed at Shreveport is 12.3 kph (7.6 mph) (U.S. Department of Commerce, 1975). The windiest seasons are winter and spring, each with an average speed of 13.8 kph (8.5 mph). Fall is the next windiest season (11.5 kph, 7.1 mph), followed by summer (10 kph, 6.2 mph). An annual frequency distribution of wind direction (wind rose) for Shreveport is presented in Figure 5-4 (U.S. Department of Commerce, 1975).

The occurrence of severe weather in the state of Louisiana results from hurricanes and lesser tropical storms, and from large thunderstorms (including tornadoes). Ice storms are very infrequent and are limited to northern Louisiana during the coldest months. Thunderstorms and tornadoes are generally limited to the spring and early summer months, but can occur during any month of the year. Maximum thunderstorm frequency usually occurs in the afternoon and evening hours. Hurricanes and tropical storms normally occur from June to November.



Calms
12.2%

0-3	4-6	7-10	11-16	17-21	21+
17.7	33.7	34.3	13.3	0.9	0.08

knots

FIGURE 5-4

ANNUAL WIND ROSE
SHREVEPORT, 1970-1974

SOURCE : DEPT. OF COMMERCE, 1975

Dispersion Meteorology. Relative atmospheric dispersion is estimated from information on atmospheric stability, mixing heights, and frequencies of inversions and stagnating anticyclones. In general, the proposed project area is characterized by atmospheric conditions favorable for the satisfactory dispersion of air pollutants (see EPA, 1981).

5.3.1.2 Existing Air Quality

The only major EPA criteria pollutant to be emitted from the mine portion of the proposed Dolet Hills Lignite Mine Project will be total suspended particulate (TSP) matter. In this section, data for TSP point emission sources affecting air quality in the project area are presented and regional ambient air quality measurements are discussed.

Inventory of TSP Emission Sources in the Project Area. Emissions data were obtained from the Air Quality Division of the LDNR, the Texas Air Control Board (TACB), and EPA's National Emissions Data System for TSP point sources within an approximate 50-kilometers (31-mile) radius of the proposed Dolet Hills Power Plant and Mine Permit area. These data were tabulated and presented in the Dolet Hills Baseline Climatology and Air Quality Report (EH&A, 1981b) and in the Draft EIS for the power plant (EPA, 1981). A total of approximately 8,300 tons per year of TSP are expected to be emitted from sources permitted to locate in this area. Most of this total will be emitted by the Cajun Electric Power Co-Op's Big Cajun No. 3 Station, to be located just southwest of Coushatta.

Ambient Air Quality Levels in the Project Area. The region surrounding the proposed project area is primarily rural, much of which is pasture or heavily wooded land. With the exception of the Shreveport area, only a few isolated point emission sources are located in the vicinity. The dispersed nature of emissions in the region and the large distances to major industrial areas contribute to acceptable air quality in the project area.

The EPA has designated the area surrounding the proposed project as attainment for TSP. The area is also designated Class II under the EPA's Prevention of Significant Deterioration (PSD) of Air Quality regulations. A Class II area is one that can sustain a moderate increase in pollutant emissions. No PSD Class I (limited growth) areas are located within 100 kilometers (62 miles) of the proposed project. The nearest such area is Caney Creek National Wilderness Area in Arkansas, approximately 273 kilometers (170 miles) to the north-northwest.

5.3.2 Effects of No Action

The no action alternative would eliminate the adverse impacts of construction and operation related to the Dolet Hills Lignite Mine Project; however, impacts resulting from the Dolet Hills Power Plant would still be incurred. With the possible exception of future construction and operation of other nearby facilities proposing to emit large quantities of TSP, the project area's air quality will remain unchanged from its present condition if the proposed project is not constructed. If new industrial development occurs in the project area, the TSP standards could become constrained at some future date. Such future sources would be limited by Federal and State agencies so as to not cause exceedances of the standards or violate any other existing or future air pollutant regulation.

5.3.3 Construction Impacts

Fugitive particulate emissions from mine site preparation and ancillary facilities construction will cause some adverse air quality impacts in areas immediately surrounding construction activities. These impacts will be short-term and localized, and air quality levels will only occasionally exceed those resulting from normal rural agricultural, timber felling, or quarry activities. Since these emissions are construction-related they are exempt from air quality impact analyses for PSD purposes.

Land clearing will be carried out as necessary prior to overburden removal and mining operations. Merchantable timber will be felled and removed. The remaining vegetation and refuse will be dozed into piles or windrows and disposed of or burned according to LDNR regulations. Burning operations will be designed to minimize adverse impacts on surrounding areas and wildlife habitats.

Some smoke may be produced by the operation of diesel engines and by other construction activities such as welding. Vehicular exhaust emissions may include small amounts of carbon monoxide, hydrocarbons, and oxides of nitrogen. These mobile source emissions are not expected to produce any exceedances of Federal or State air quality standards.

Fugitive dust will be produced on-site by heavy earth-moving equipment involved in excavation and construction activity and by vehicular traffic on unpaved roads. The impacts of emissions from roadway and construction area traffic will be minimized by the use of sprinkler trucks. The areas adjacent to the haul roads will be mulched and revegetated as soon as possible after construction.

5.3.4 Operations Impacts

The operation of the proposed Dolet Hills Lignite Mine will cause particulate matter to be emitted into the atmosphere. Some of the potentially adverse impacts of particulate emissions include: deposition of dust particles on vegetation potentially reducing its attractiveness, and locally reduced visibility during dry, windy atmospheric conditions. However, most of the proposed project's emissions will be fugitive in nature, which are composed primarily of large particles which settle out of the atmosphere within a short time and distance from where they originate.

5.3.4.1 Impact of Process Emissions

Adverse impacts from lignite processing facilities at the mine will be minimal. There will be no beneficiating facilities in operation on-site. Feeder breakers used to reduce the size of the lignite for conveyor handling will be the major emitters of process particulate matter. No more than two breakers will be in use at any one time. Using conservative estimates, and assuming the use of water sprays as a control measure, the approximate particulate emission rate from each breaker will be 28 tons per year or 56 tons per year total (EPA, 1977a), far less than the cutoff point of 250 tons per year for PSD applicability.

The remaining load-in, load-out, and conveyor transfer points will emit a total of less than 0.1 tons per year of particulates, assuming the use of water sprays as a control measure (EPA, 1978a).

5.3.4.2 Impact of Fugitive Emissions

The proposed mining operations, consisting primarily of removal and replacement of large amounts of overburden material, and of the removal and transport of lignite, will generate fugitive dust. However, because the emissions from the mine operations will be intermittent and spread over a large area, and because significant particle settling will occur very close to each source, air quality impacts are expected to be minor. In addition, the fugitive dust impacts will be tempered somewhat by the relatively high moisture content of the overburden and lignite. At the present time, no studies have been conducted which assess fugitive emissions from Gulf Coast lignite mines. Fugitive emission assessments conducted at western surface mines are considered to be in applicable to the Dolet Hills Lignite Mine because of differences in climatological, geological, and soil characteristics. The fugitive emissions were exempt from PSD review (Divita, 1981; see letter of exemption at end of Section 6.0).

Some of the supplemental control measures used to mitigate the impact of fugitive dust emissions will include: application of water sprays on haul roads and service roads, rapid revegetation of all disturbed areas, and minimization of dumping heights.

5.3.4.3 Impact of Radioactive Emissions

Trace amounts of uranium and thorium are present in the Dolet Hills lignite, primarily as uranium-238 (U-238) and thorium-232 (Th-232), respectively along with some 28 decay series' products. Typical values of U-238 and Th-232 measured in the Dolet Hills lignite are 1.25 and 2.18 parts per million by weight (ppm_w), respectively (Paul Wier Co., 1981).

Radon Emissions from Mining Operations

Radon-222 (Rn-222), a decay series radionuclide of U-238, will be released into the atmosphere as a result of mining operations at the proposed Dolet Hills Lignite Mine Project. Radon-222 is normally emanated continuously from virgin undisturbed topsoil. The amount of Rn-222 emanated is related to the amount of U-238 present in the soil or the near-surface material being evaluated. Soils have been reported to have an average concentration of U-238 of 1.8 ppm_w (NCRP, 1975). Because the concentration of U-238 in the Dolet Hills lignite, 1.25 ppm_w, is less than the above-referenced concentration in average soil of 1.8 ppm_w, the emanation rate of Rn-222 from any exposed lignite seams or lignite storage piles would not be expected to be greatly different from the average soils. Therefore, release of Rn-222 by the exposed lignite during mining operations is not expected to be significant.

The concentrations of U-238 and Th-232, and their associated decay series' radionuclides, vary by both horizontal and vertical locations within overburdens (Rosholt et al., 1966; University School of Public Health et al., 1982). The actions of mining and land reclamation will have the effect of relocating various layers of overburden material containing different amounts of these radionuclides. The Rn-222 emanation rate from the surface at some locations in the reclaimed mine area will be less than the predisturbed emanation rate, while at other locations in the reclaimed mine area, it will be greater. These changes in the radon emanation rate will be caused by relocating existing pockets of overburden material containing varying contents of radium-226 (Ra-226), the parent nuclide of Rn-222, and by changes in topsoil and overburden porosity.

5.3.5 Combined Impacts of Power Plant and Mine

Operation of the proposed power plant and mine, located at adjacent sites, will adversely impact the air quality of the project area. However, the maximum impacts from the mine and power plant operations will not necessarily coincide. Mining operation emissions (mostly fugitive dust emitted at ground level) will impact at points immediately adjacent to the mining area and will decrease rapidly with distance. Power plant emissions (gases and particulate matter emitted at stack-top level) will impact at greater distances downwind. The power plant facility was issued a PSD permit (#LA-117) on 1 September 1981.

The combined effects of construction of the proposed power plant and mine on air quality will be an increase in fugitive dust during the time when both construction projects are at peak activity, resulting in localized, short-term adverse impacts.

The power plant and the mine may each have an adverse impact on the local meteorology of the area. The primary impact from the power plant will be the development of fog immediately downwind of the cooling towers during humid, stable conditions. The primary impact from the mine will be the potential of locally reduced visibility due to blowing dust during dry, windy conditions. Therefore, combined project-related meteorological impacts will be minor, as the impacts of each operation generally occur during dissimilar atmospheric conditions.

5.3.5.1 Combined Impacts of Radioactive Emissions from the Power Plant and Mine

The emanation rate of Rn-222 from the exposed lignite seams during mining operations is not expected to be greatly different from the emanation rate from average soils. Relocation of overburden material by reclamation will change the Rn-222 emanation rate from the surface of the reclaimed land. Depending on the initial profiles of Ra-226 concentrations in the overburden, the Rn-222 emanation rate will be less than the predisturbed rate at some locations, while at other locations in the reclaimed mine area, it will be greater.

The potential health effects associated with stack releases depend upon the radionuclide concentrations in the lignite, the amount of lignite burned, and the amount of fly ash released from the stack. The annual radionuclide emission rates for the proposed units are listed in Table 5-11. The most direct pathway for human exposure is inhalation of radioactive aerosols directly from the plume. Other pathways such as deposition on or uptake into surface water, food plants, or animals are considered trivial compared to the direct pathway (Beck, 1980).

Table 5-12 compares normal background levels with the maximum annual average ground-level concentrations resulting from the continuous operation of the units at full load. The operation of the lignite units will contribute only a minor fraction of the existing ambient concentrations of airborne radionuclides. It follows that foliar deposition and surface water contamination due to the plume will be minimal.

Virtually all of the non-gaseous radionuclides originally contained in the lignite will reside in permanent solid waste disposal areas after the lignite is burned. The fly ash will be mixed with the scrubber sludge prior to final disposal. The reestablishment of Rn-222 equilibrium would require only one month, provided that there was little opportunity for radon to escape from the ash. If the average ash content of the lignite fuel is approximately 25 percent, then the concentrations of the radionuclides in the ash will be about four times the concentrations found in the raw lignite. However, according to Beck et al. (1980), fly ash is relatively resistant to both leaching and radon release due to emanation. The reduction of the mobility of radioactive materials within the ash is caused by the conversion of the ash content in the lignite during burning into a highly insoluble glassy substance. Less than one percent of the radon contained in the ash is expected to be emanated. In addition, the concentrations of the radionuclides in the mixed scrubber sludge and fly ash will be less than the concentrations in the fly ash alone.

5.4 SOUND QUALITY

Neither the State of Louisiana nor De Soto Parish has any noise regulations limiting maximum noise levels from surface mine operations such as those levels proposed for the

TABLE 5-11

ANNUAL NUCLIDE EMISSION RATES FROM UNITS 1 AND 2

Nuclide	Uncontrolled Throughput[a] (Ci/Y)	Controlled Emission[b] (Ci/Y)
Uranium-238	1.59	0.00509
Thorium-230	1.59	0.00509
Radium-226	1.59	0.00509
Radon-222	1.59	1.59[c]
Lead-210	1.59	0.00509
Polonium-210	1.59	0.00509
Thorium-232	0.92	0.00295
Thorium-228	0.92	0.00295
Radium-228	0.92	0.00295

Note: The concentrations of Uranium-238 and Thorium-232 in the Dolet Hills lignite were measured, while the concentrations for the other nuclides listed were estimated based on the assumption of secular equilibrium.

a. Assuming 8.41 million tons of lignite/year. The unit curie, Ci, is defined as 3.7×10^{10} disintegrations per second.

b. Assuming 99.75% and 99.93% fly ash removal efficiencies for Units 1 and 2, respectively.

c. Assuming no collection of radon gas prior to release to the atmosphere.

TABLE 5-12

ESTIMATED MAXIMUM ANNUAL GROUND-LEVEL CONCENTRATIONS, AMBIENT BACKGROUND LEVELS, AND MAXIMUM PERMISSIBLE CONCENTRATIONS

Nuclide	Units 1 and 2 Maximum Annual Ground-Level Concentrations[a] (aCi/m^3)	Background Concentrations[b] (aCi/m^3)	Maximum Permissible Concentrations[c] (aCi/m^3)
Uranium-238	0.58	100 - 400	50,000,000
Thorium-230	0.58	45	3,000,000
Radium-226	0.58	80 - 100	60,000,000,000
Radon-222	361.1	100,000,000- 500,000,000	10,000,000,000
Lead-210	0.58	10,000	80,000,000
Polonium-210	0.58	1,000	70,000,000
Thorium-232	0.34	30	4,000,000
Thorium-228	0.34	30	2,000,000
Radium-228	0.34	N/A	10,000,000

Note: atto, a, is 10^{-18}.

N/A - Not Available.

a. Based on EPA-approved annual dispersion modeling techniques.

b. From NCRP-45 (1975).

c. From National Bureau of Standards Handbook 69 (1959). The Maximum Permissible Concentrations (MPCs) listed are for continuous occupational exposure. The Federal Radiation Council (1960) recommends that exposure to the general public be restricted to less than or equal to one tenth of the occupational MPCs in air.

Dolet Hills Lignite Mine Project. As directed by Congress in the Noise Control Act of 1972 and amended by the Quiet Communities Act of 1978, EPA has developed appropriate noise level guidelines. The equivalent sound level (L_{eq}) is the A-weighted sound level that is "equivalent" to an actual time varying sound level, in the sense that it has the same total energy for the duration of the sound. Outdoor L_{eq}'s in excess of 55 dBA for 24 hours are considered annoying for some persons, while levels of 70 dBA or more for 24 hours can result in hearing loss (EPA, 1974). The day-night sound level (L_{dn}) is the 24-hour equivalent sound level with the nighttime (10:00 p.m. to 7:00 a.m.) sound level penalized by the addition of 10 dBA. EPA generally recognizes rural areas to have an average L_{dn} of less than 50 dBA (EPA, 1978b). EPA has also developed guidelines for a short-term goal L_{dn} of 65 dBA and a long-term goal L_{dn} of 55 dBA for noise levels outside of structures such as buildings, residences, etc. (EPA, 1977b). For residences, the U.S. Department of Housing and Urban Development (HUD) considers outdoor L_{dn}'s of 65 dBA or less to be "acceptable". L_{dn}'s above 65 dBA and not exceeding 75 dBA are considered "normally acceptable", and levels above 75 dBA are "unacceptable" (HUD, 1980).

5.4.1 Existing Environment

The Dolet Hills Lignite Mine Project area can best be classified as a rural environment. The major noise sources in the vicinity of the permit area are spread over an area in excess of 194.2 square kilometer (75 square miles) and represent general activities from a major population center, Mansfield, and motor vehicle noise associated with U.S. 84 and LA highways 175, 177, 346, 510, and 522. Representative noise levels were computed for each source using currently accepted techniques for determining community and traffic noise. Noise levels associated with oil and gas well operations were not considered due to their insignificant contribution to the overall project area background sound level. Noise levels from timber removal operations can be significant at times, however, due to the transient nature of the activities, contributions to the noise level due to timber removal were not considered in the assessment of the existing environment. There are no major airports or railroads within 3.2 kilometers (2 miles) of the permit area.

L_{dn}'s for communities can be computed (National Research Council, 1977) using the equation: $L_{dn} = 10 \log \rho + 22$ dB, where ρ is the population density in people per square mile. The calculated L_{dn} for Mansfield was found to be 52 dBA, which is within the HUD acceptability limit of 55 dBA for residential areas.

No noise measurement data were available for pertinent sections of the roadways near the permit area, so traffic characteristics and accepted methods of motor vehicle noise prediction were employed to estimate traffic noise. Motor vehicle noise was quantified using the Federal Highway Administration (FHWA) Noise Predictor Model, SNAP 1.0, and was based upon Louisiana Department of Transportation average 24-hour traffic data. SNAP 1.0 results show traffic noise to be less than 55 dBA beyond 243.8 m (800 feet) of all the roadways in the permit area.

To adequately describe the existing sound quality, noise levels have been estimated for locations around the proposed permit area. The previously discussed noise sources are typical of the permit area, but due to the area's rural nature, any specific point is usually affected by only one or two of the noise sources mentioned. Using hemispherical radiation analysis techniques, L_{dn}'s have been projected to 16 baseline sensitive receptor locations, comprising 15 churches and the Mansfield Battle Park. All are located within 1.6 kilometers (1 mile) of the permit area boundaries. Levels were found to range from 40 to 60 dBA at the baseline receptor locations.

In summary, permit area L_{dn}'s were found to range between approximately 35 dBA in purely rural areas to as high as 60 dBA in those areas heavily influenced by motor vehicle traffic. The major portion of the permit area has an existing ambient noise level varying between 45 and 50 dBA.

5.4.2 Effects of No Action

The no action alternative would eliminate the adverse impact of construction and operations related to the Dolet Hills Lignite Mine Project. Higher traffic volumes on US 84 and LA 175 in association with general population growth in the area could increase highway traffic noise levels by 1 to 2 dBA. Otherwise, little or no change in the permit area's baseline ambient sound level is anticipated with the no action alternative.

5.4.3 Construction Impacts

Noise-producing construction activities at the proposed Dolet Hills Mine Facility can be categorized into two basic activities: (1) ancillary facilities construction (i.e., field workshops, main office facilities, dragline erection yard, etc.), and (2) road construction.

Ancillary facilities construction is scheduled to begin in July 1983 and continue through October 1985 when mining commences.

Construction of the dragline erection yards, field workshops, and main office facilities is considered similar to that of typical industrial facilities (EPA, 1977b). The use of such equipment as backhoes, bulldozers, scrapers, and dump trucks during clearing and excavation related to site preparation will constitute the noisiest period of construction. Sound levels at 15.2 meters (50 feet) from each type of construction equipment are 77, 82, 88, and 78 dBA, respectively (EPA, 1977b). The equivalent sound level (L_{eq}) during this period is estimated to be 84 dBA at 15.2 meters (50 feet) from the center of activity at each site. Further, foundation finishing and structure erection noise levels may result in a short-term increase in overall noise levels when these jobs are performed simultaneously with excavation and clearing at adjoining facility sites.

Construction of mine access roads and lignite haul roads will occur periodically throughout the life of the mine. Sound levels dBA at 15.2 meters (50 feet from the source) for typical equipment employed during these activities are 88 dBA (scraper), 85 dBA (grader), 78 dBA (gravel and water trucks), and 77 dBA (backhoe) (EPA, 1977b). The L_{eq} during this period is estimated to be 82 dBA at 15.2 meters (50 feet) from the center of activity.

When considering the effects of construction activities on local ambient sound levels of the permit area, "worst-case" conditions are assumed to occur occasionally when activities are performed along the perimeter of the proposed mine area boundary. Moreover, increased noise levels at other mine perimeter locations, as well as within the mine boundaries, will be somewhat attenuated by existing topography and vegetation. It is anticipated that under "worst-case" conditions increased noise levels associated with construction activities will be short-term and will have minor adverse effects on local residences.

5.4.4 Operation Impacts

Noise producing operations of the proposed mine can be categorized into four separate activities: timber and brush removal, surface soil and overburden removal, lignite mining, and spoil grading and revegetation. These activities can occur simultaneously, although spread out over an area of over 62.1 square kilometers (24 square miles).

Timber and brush within a mine block will be removed prior to mine operation start up. Trees and brush will be felled using chain saws and/or bulldozers. Timber will be loaded onto dump trucks for transportation from the mine block. Typical equipment and their sound levels at 15.2 meters (50 feet) (EPA, 1977b) include; bulldozer (82 dBA), chain saw (78 dBA), loader (78 dBA), and dump truck (78 dBA). An L_{eq} of 85 dBA at 15.2 meters (50 feet) from the center of activity is expected to occur during this phase.

Overburden will be removed and stockpiled by use of electric draglines, accompanied by a crawler bulldozer for leveling ahead of the machines. In addition, motorized scrapers may be employed in the island areas to the northwest instead of draglines. A prestrip operation will normally be carried out using bucketwheel excavators where overburden exceeds 21 meters (70 feet). Sound levels at 15.2 meters (50 feet) from the above referenced equipment (EPA, 1977b) are 58, 82, 88, and 82 dBA, respectively. Overburden removal is anticipated to occur on a 24-hour per day basis with an L_{eq} contribution at 15.2 meters (50 feet) of 90 dBA (L_{dn} of 96 dBA).

A hydraulic backhoe will be used to remove lignite in the pit. The lignite will be loaded directly into 70-ton bottom dump trucks which will travel from the pit to a conveyor loading facility. Typical equipment and their sound levels at 15.2 meters (50 feet) (EPA, 1977b) include: hydraulic backhoe (82 dBA), bottom dump trucks (88 dBA), loading hopper (78 dBA), and feeder breaker (83 dBA). The sound level contribution associated with lignite loading will be substantially lower due to the depth of excavation. In effect, the pit walls will act as noise barriers, attenuating up to 15 dBA per pit (Transportation Research Board, 1976). This noise reduction will not occur for lignite handling operations since they will take place outside the pit. Lignite loading and handling is anticipated to occur on a 24-hour per day basis with handling operations being the loudest activity. Lignite handling is expected to have an L_{eq} contribution at 15.2 meters (50 feet) of 88 dBA (L_{dn} 94 dBA) while lignite loading will have an L_{eq} of 72 dBA and an L_{dn} of 78 dBA (with a 15 dBA pit wall attenuation).

Overburden regrading and revegetation (reclamation) will be generally concurrent with mining. Typical equipment and their sound levels at 15.2 meters (50 feet) include bulldozers (82 dBA), graders (85 dBA), and large trucks (88 dBA). The L_{eq} contribution during this period is estimated to be 88 dBA at 15.2 meters (50 feet) from the center of activity.

Studies undertaken to review the case histories of community response to intruding noise indicate the following (EPA, 1974):

Sound Level Increase	Expected Community Response
0 to 5 dB	No observed reaction
5 to 10 dB	Sporadic complaints
10 to 15 dB	Widespread complaints
15 to 25 dB	Threats of community action
More than 25 dB	Vigorous community action

Based on a "worst-case" scenario with all mine operations occurring simultaneously and within proximity to each other, day-night sound levels are anticipated to be within the EPA short-term goal of 65 dBA and the long-term goal of 55 dBA beyond 614.5 meters (2,016 feet) and 1,950.7 meters (6,400 feet), respectively, from the center of mining activity. With mining activities occurring along the permit boundary, L_{dn}s are expected to attenuate to 71 dBA at the nearest residence in the community of Rambin Store, 300.4 meters (1,000 feet) away. Day-night noise levels associated with mining operations are expected to range from 57 to 76 dBA at thirteen of the sixteen baseline noise receptor locations. These levels represent an increase in the ambient sound level of between 3 and 22 dBA. At the other three sites (Mundy Church, Mt. Carmel Church, and the church in Naborton), the mine's operational noise levels will be below the baseline noise levels and will, therefore, have no adverse impact. The greatest changes will occur at the Antioch Church along LA 175 (22 dBA), the Shiloh Church 3.2 kilometers (2 miles) south of the Mansfield Battle Park (21 dBA), the St. Mary's Church, 4.8 kilometers (3 miles) southwest of the community of Rambin Store (17 dBA) and the Grove Hill Church 3.2 kilometers (2 miles) northeast of LA 175 near the De Soto Lookout Tower (19 dBA). Based on mining operations, an L_{dn} of 69 dBA is expected at the Mansfield Battle Park. This reflects an increase of 15 dBA over the baseline ambient sound level. The sound level increases represent adverse noise impacts at these receptors which could be significant depending on the timing and activities occurring at these nearby receptors. Under worst-case conditions, the highest day-night noise level is expected to occur at the Antioch Church (L_{dn} = 76 dBA); however, equivalent sound levels (i.e., the perceived sound levels) will not exceed 70 dBA at any of the receptors for a 24-hour period. It should be noted that for this assessment, these increases in noise levels present a potential major problem because of possible conflicts with and/or disruptions of nearby routine or planned activities, not because of public health concerns.

It should be emphasized that the previously discussed noise levels are based on a worst-case scenario with mining operations occurring near the permit boundary. With operations occurring towards the center of the mine, noise levels will decrease to near the ambient baseline level beyond the permit boundary.

5.4.5 Combined Impacts of Power Plant and Mine

Construction activities at the proposed plant and mine and along the transportive ROWS will be carried out at various sections of the combined project's 12,683.7-hectare (31,341-acre) area. The mine ancillary facilities construction area will occupy 209.2 hectares (517 acres) of this site and the proposed power plant will occupy 73.2 hectares (181 acres). Thus, only a small percentage of the total acreage will be involved in the noise-producing activities during the construction period of the mine facilities and the power plant. The pieces of noise-producing equipment used on the two sites are sufficiently distant from each other and of such a nature that the combined effects, during the period when construction of the power plant and mine are occurring simultaneously, are not measurably different from the individual effects. Traffic flow along US 84 and LA 175 from construction personnel will increase slightly and will result in only minor contributions to the ambient noise levels.

The combined effects of operation noise from the proposed power plant and mine are additive in that noise-producing activities will occur simultaneously. However, the overall size of the combined site (12,683.7 hectares (31,341 acres)) and orientation of the respective operations on their individual sites (particularly the transient nature of mining operations) are such that noise impacts will not be greater for the combined sites than for the independently operating sites.

5.5 ECOLOGY

The following sections describe major baseline ecological characteristics of the proposed Dolet Hills Lignite Mine Project and potential project impacts. A more detailed treatment of on-site ecological conditions is presented in the Baseline Ecology Report, Dolet Hills Project (EH&A, 1980c). Many of the vegetational communities described in the Draft EIS for the Dolet Hills Power Plant (EPA, 1981) also characterize the mine permit area.

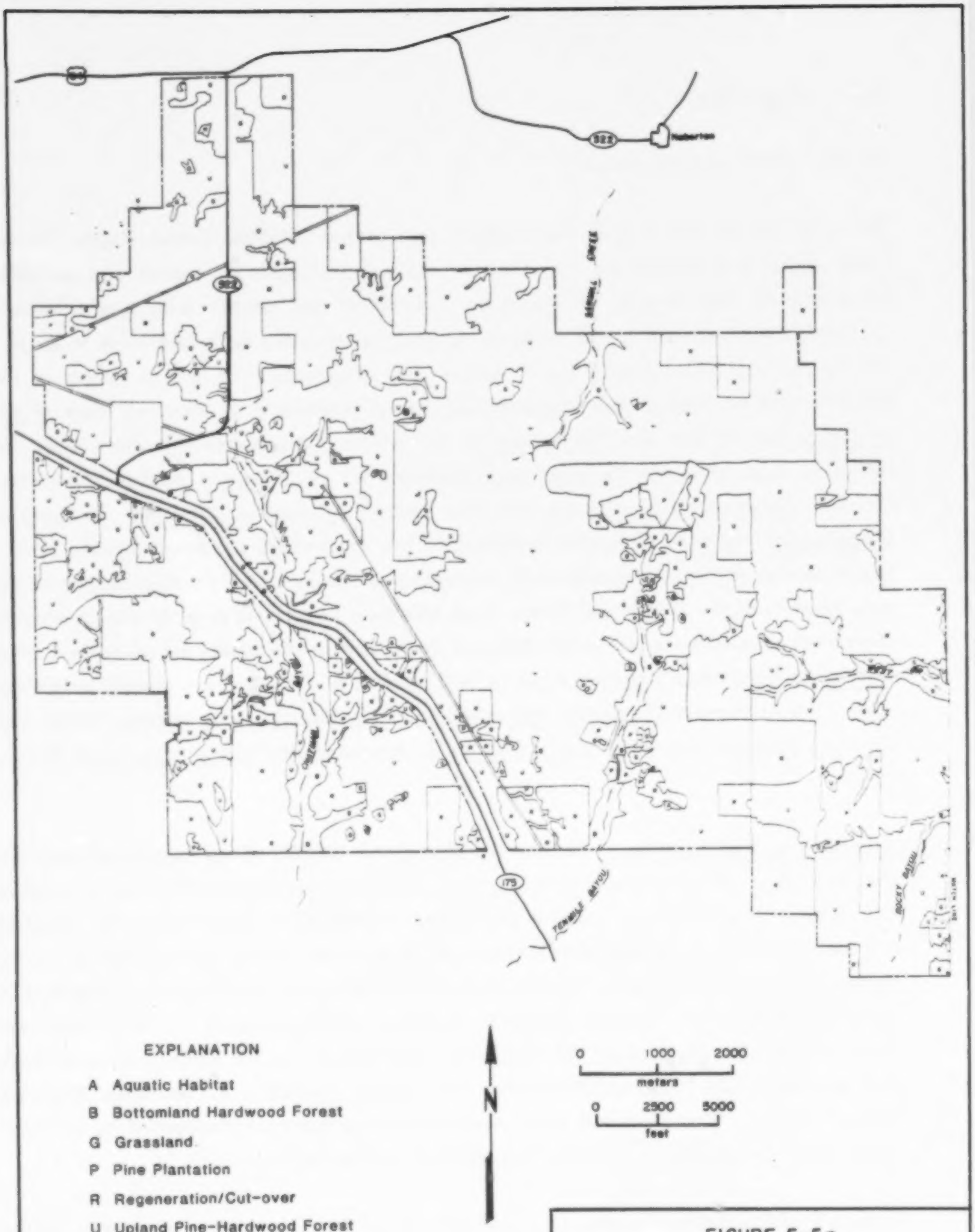
5.5.1 Vegetation

5.5.1.1 Existing Environment

The mine permit area lies in the southern part of the Oak/Pine Forest Region (Braun, 1950) which corresponds to the Tertiary Upland physiographic region and occupies approximately one-seventh of Louisiana. Although the permit area was originally forested, the old-growth forest has been replaced by second-growth forest due to logging and by pastures and oldfields due to agricultural influences. The upland forests of the Oak/Pine Forest Region are characterized by an abundance of shortleaf pine (*Pinus echinata*) and loblolly pine (*Pinus taeda*), as well as a number of important oaks and hickories, e.g., white oak (*Quercus alba*), southern red oak (*Quercus falcata*), mockernut hickory (*Carya tomentosa*), and bitternut hickory (*Carya cordiformis*). Sweetgum (*Liquidambar styraciflua*) is also important. The bottomland hardwood forests of the Oak/Pine Forest Region are essentially extensions of the deciduous hardwood forest of the alluvial plain of the Mississippi River. They contain a large number of species, including trees that are characteristic of alluvial soils throughout the deciduous forest, such as elms (*Ulmus* spp.) and ashes (*Fraxinus* spp.), as well as trees of southern or southwestern range, such as bald cypress (*Taxodium distichum*), overcup oak (*Quercus lyrata*), willow oak (*Quercus phellos*), sugarberry (*Celtis laevigata*), and cedar elm (*Ulmus crassifolia*) (Braun, 1950).

Vegetational Communities. Of the 11,968 hectares (29,573 acres) associated with the proposed Dolet Hills mine permit area, a total of 7,502 hectares (18,538 acres) is forested land (Figure 5-5a and b and Table 5-13). Approximately 6,771 hectares (16,731 acres) of the forestland occurs as upland pine/hardwood forests, and 731 hectares (1,807 acres) as bottomland hardwood forests. The remaining 4,466 hectares (11,035 acres) is composed of cutover/regeneration (2,268.7 hectares; 5,606 acres), grasslands (1,412.8 hectares; 3,491 acres), pine plantation (700.9 hectares; 1,732 acres), hydric habitats (i.e., swamps and marshes: 70.3 hectares; 173 acres), and aquatic habitats (13.3 hectares; 33 acres) (EH&A, 1980c). Approximately 102.3 hectares (253 acres) were delineated as wetlands under USCE jurisdiction by the New Orleans District (see Section 6.2.1).

Upland Pine/Hardwood Forests. Upland pine-mixed hardwood forest vegetation within the permit area varies considerably in species composition, ranging from pine/oak/sweetgum forest to mesic mixed hardwood forest. Though the structure of the native


322
175
TENMILE BAYOU
0
1000
2000
meters
0
2500
5000
feet
N

EXPLANATION

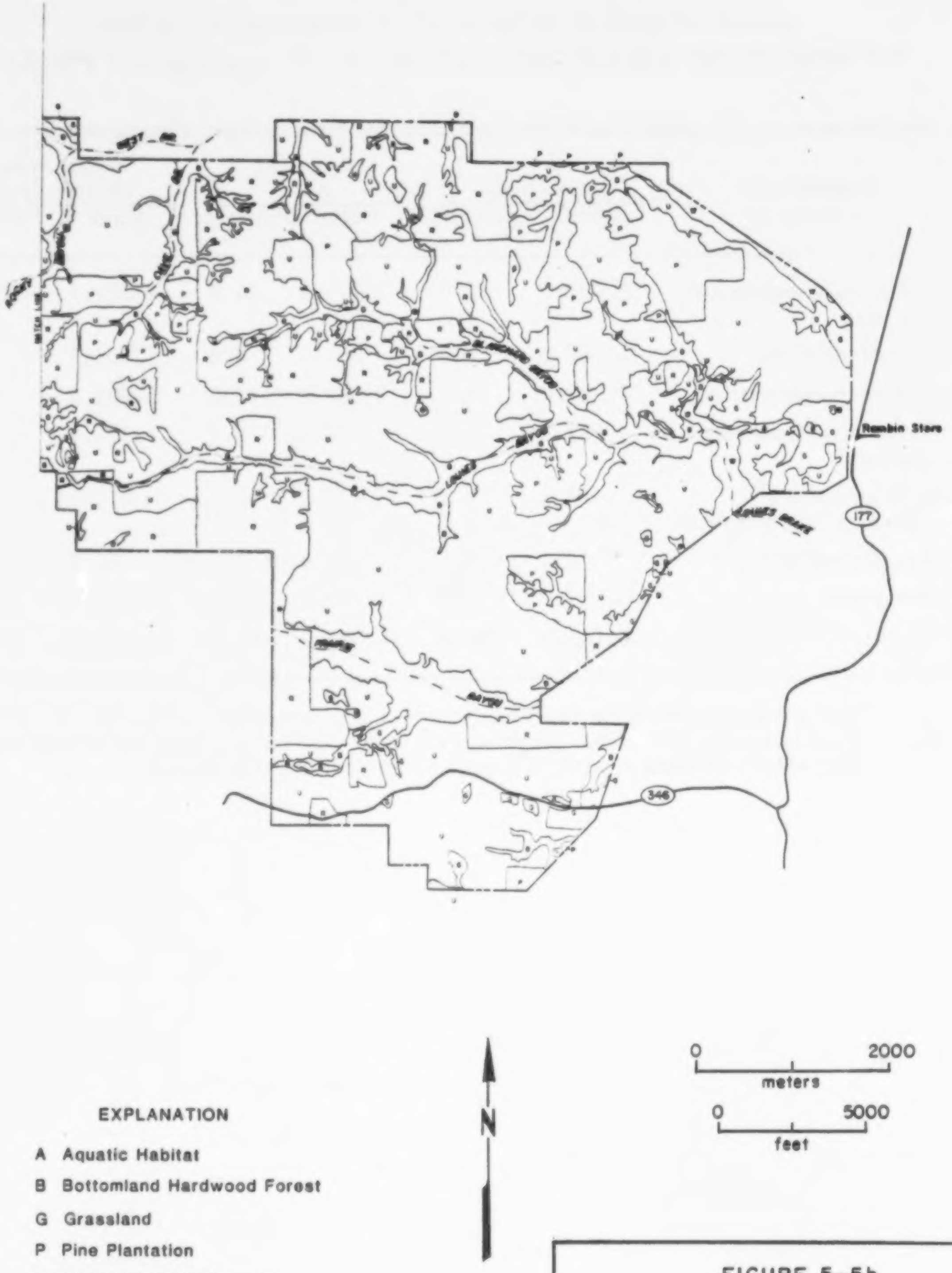
- A Aquatic Habitat
- B Bottomland Hardwood Forest
- G Grassland
- P Pine Plantation
- R Regeneration/Cut-over
- U Upland Pine-Hardwood Forest
- W Hydric Habitats (Swamps and Marshes)

FIGURE 5-5a

VEGETATION OF THE PERMIT AREA

West Area

SOURCE: EH&A


Rambin Store
177
346
N
0
2000
meters
0
5000
feet

EXPLANATION

A Aquatic Habitat
B Bottomland Hardwood Forest
G Grassland
P Pine Plantation
R Regeneration/Cut-over
U Upland Pine-Hardwood Forest
W Hydric Habitats
(Swamps and Marshes)

FIGURE 5-5b
VEGETATION OF THE PERMIT AREA
East Area

SOURCE: EH&A

TABLE 5-13

AREAL EXTENT OF VEGETATIONAL COMMUNITIES WITHIN THE MINE PERMIT AREA OF THE PROPOSED DOLET HILLS LIGNITE PROJECT

Vegetational Community	Mine Area		Ancillary Area		Total Mine Permit Area	
	Acres[a]	Percent	Acres	Percent	Acres	Percent
Upland pine-hardwood forests	9,001.7	58.2	7,729.4	54.8	16,731.1	56.6
Pine plantations	1,055.0	6.8	676.7	4.8	1,731.7	5.9
Cutover/regeneration	2,243.4	14.5	3,362.2	23.8	5,605.6	19.0
Bottomland hardwood forests[b]	783.3	5.1	1,023.8	7.3	1,807.1	6.1
Hydric habitats[b] (swamps and marshes)	17.3	0.1	155.8	1.1	173.1	0.6
Aquatic habitats	16.3	0.1	16.9	0.1	33.2	0.1
Grasslands	2,349.0	15.2	1,142.2	8.1	3,491.2	11.8
TOTAL	15,466.0	100.0	14,107.0	100.0	29,573.0	100.1

[a] See conversion chart for conversion to metric equivalent.

[b] Approximately 253 acres of bottomland hardwood forests and hydric habitats are delineated wetlands under USCE jurisdiction (see Section 6.2.1).

pine/hardwood forest varies depending upon successional status, present disturbances, and historical factors, the most commonly encountered overstory tree species in the non-mesic uplands is loblolly pine. Other important overstory species include shortleaf pine, sweetgum, white oak, southern red oak, mockernut hickory, water oak (*Quercus nigra*), post oak (*Quercus stellata*), and winged-elm (*Ulmus alata*). Many so-called native stands have been subjected to selective cutting for timber improvement. In some stands most of the hardwoods have been eliminated in this manner. Mesic slope and hillside bog forests support such trees as eastern hop-hornbeam (*Ostrya virginiana*), white oak, sweetgum, beech (*Fagus grandifolia*), blackgum (*Nyssa sylvatica*), and swamp bay (*Magnolia virginiana*). These mesic upland communities are locally important on shaded, north-facing slopes and in sheltered coves in the permit area. Though relatively insignificant in terms of areal extent, mesic upland forests are important because of the uncommon plant species they may harbor.

Pine Plantations. The pine plantations that occur in the project area are composed of even-aged loblolly and/or shortleaf pine. The older stands presently being harvested date from the mid-1950's. The trees average about 25 centimeters (ten inches) diameter-at-breast-height (dbh), 15-16 meters (49 to 52 feet) in height, and are planted in rows at densities ranging from about 700 to 1,300 trees/hectare (284 to 527 trees/acre). Understory vegetation is usually sparse or absent as a result of periodic controlled burning.

Cutover/Regeneration. Cutover/regeneration areas in the permit area are areas that have been clear-cut or selectively cut for timber-harvesting or other purposes within the past several years. Such areas are presently undergoing secondary succession and are dominated by pine and/or hardwood seedlings and saplings up to approximately six to nine meters (20-30 feet) in height. These young woody successional species include loblolly and shortleaf pine, sweetgum, southern red oak, water oak, red maple (*Acer rubrum*), and hawthorn (*Crataegus* sp.). With proper management (i.e., selective cutting of hardwoods), many of these cutover/regeneration areas should become even-aged pine stands. In other cases, these areas are planted in pine monocultures soon after timber-harvesting.

Bottomland Hardwood Forests. The bottomland mixed hardwood forest communities occur upon floodplains associated with the various bayous and creeks which traverse the permit area. These bottomland forests have intermittent flooding not of sufficient duration to support a predominance of species indicative of swamps with prolonged flooding. A portion of the bottomland forest described in this section was delineated as wetlands by the USCE.

Dominant overstory species in bottomland mixed hardwood forest within the permit area include sweetgum, sugarberry, water oak, American hornbeam (*Carpinus caroliniana*), loblolly pine, and boxelder (*Acer negundo*). Bottomland understories predominantly consist of red maple, water oak, American hornbeam, sweetgum, and various elms. The shrub layer of bottomland forests include shrub species such as American beautyberry (*Callicarpa americana*), giant cane (*Arundinaria gigantea*), witch-hazel (*Hamamelis virginiana*), and flowering dogwood (*Cornus florida*), along with tree seedlings of red maple, sugar maple (*Acer saccharum*), sassafras (*Sassafras albidum*), and American holly (*Ilex opaca*). The ground cover consists of herbaceous species such as May-apple (*Podophyllum peltatum*), Japanese honeysuckle (*Lonicera japonica*), green dragon (*Arisaema dracontium*), Carolina elephant's-foot (*Elephantopus carolinianus*), and various violets (*Viola* spp.).

Hydric Habitats. Hydric habitats within the mine permit area include permanently or semipermanently inundated or saturated swamps, marshes, and bogs. Of these, permanently or semipermanently inundated or saturated swamps are most common in the permit area. Two large swamp complexes, Chemard Lake and Dolet Brake, lie immediately to the east of the mine permit area. The relatively minor swamp known as Louies Brake and small portions of Dolet Brake and Sample Brake, however, comprise practically all the hydric habitats, as defined above, within the permit area. This swamp acreage is included in the areas (approximately 102.3 hectares or 253 acres) delineated as wetlands under the jurisdiction of the USCE on the east boundary of the permit area (see Section 6.2.1 and Figure 4-6b). In Louies Brake, bald cypress, some with diameters of over 180 cm (71 inches), form scattered near-monocultures within the swamp. However, stands dominated by overcup oak are more representative of the limited swamp acreage in the permit area. Important subdominants in overcup oak swamps include bald cypress, sugarberry, water locust (*Gleditsia aquatica*), water-elm (*Planera aquatica*), willow oak, and common buttonbush. The understory in overcup oak swamps typically consists almost entirely of swamp privet (*Foresteria acuminata*). Duckweed (*Lemna minor*) and water fern (*Azolla caroliniana*) are locally abundant, but herbaceous species are otherwise lacking, except for sedges (*Carex* spp. and *Cyperus* spp.), rushes (*Juncus* spp.), and wapato (*Sagittaria latifolia*) along the banks.

Marshy land in the permit area is quite limited in areal extent. Marshes are generally small and occur at the unforested periphery of swamps and ponds and where roads impede drainage. Representative marsh plants include burhead (*Echinodorus cordifolius*), spike-sedge (*Eleocharis* spp.), sedges, softrush (*Juncus effusus* var. *solutus*), lizard's tail (*Saururus cernuus*), black willow (*Salix nigra*), and smartweed (*Persicaria* spp.).

In addition to swamps and marshes, a third type of hydric habitat (hillside seepage bogs) occurs in the project area. Bog communities are generally too small to be delineated on vegetation maps. Nonetheless, bogs are important habitats because they support a relatively large number of uncommon plant species when compared to other habitats. Bogs occur in upland areas at the base of slopes and in draws where seepage water maintains continuously saturated soil conditions. Herbaceous species comprising the more or less distinctive flora of the bogs include sphagnum mosses (*Sphagnum* spp.), yellow fringed orchid (*Habenaria ciliaris*), southern twayblade (*Listera australis*), violet (*Viola primulifolia*), and others. Uncommon herbaceous species associated with bogs include monkey flower (*Mimulus* sp.), burmannia (*Burmannia* sp.), green adder's mouth (*Malaxis unifolia*), three birds orchid (*Triphora trianthophora*), and green rein-orchid (*Habenaria clavellata*). Dominant tree species in bogs include sweet-gum, blackgum, swamp bay, and American hornbeam; whereas dominant shrubs include possum-haw (*Viburnum nudum*), viburnum (*Viburnum* sp.), tassel-white (*Itea virginica*), and azalea (*Rhododendron* sp.).

Aquatic Habitats. Aquatic habitats within the permit area generally include bayous, streams, and small stock ponds. Woody species typical of streamsides in the permit area include trees such as sycamore (*Platanus occidentalis*), black willow, red ash, water hickory, overcup oak, river birch (*Betula nigra*), water-elm, red maple, and sugarberry, along with shrubs like common buttonbush, giant cane, common elder-berry, and swamp privet. Typical woody species along the margins of ponds include black willow, sassafras, sea-myrtle (*Baccharis halimifolia*), common buttonbush, and wax-myrtle. Among the herbs, duckweed and water fern often occur in ponds, while lizard's tail, smartweed, Walter's St. John's-wort (*Hypericum walteri*), deer-grass (*Rhexia mariana* var. *mariana*), false nettle, and seed-box (*Ludwigia alternifolia*) are common along the margins of both ponds and streams.

Grasslands. Grasslands within the permit area predominantly consist of coastal and common bermuda grass (*Cynodon dactylon*) pastures and hayfields, along with a few oldfields, over-grazed pastures, residential lawns, ROWS, and waste areas. Oldfields consist of abandoned croplands and pastures dominated by broomsedge (Andropogon virginicus) and being invaded by shrubs and trees, particularly loblolly pine, sweetgum, pasture haw (Crataegus spathulata), and common persimmon. Tame pastures dominated by bermuda grasses or bahia grass (Paspalum notatum) occur throughout the permit area. These pastures are used for both cattle-grazing and hay-cutting. The very limited acreage devoted to croplands within the permit area is included under the "grassland" vegetational type. Although these croplands are mainly small domestic gardens, a few acres of row crops (watermelons, soybeans, cotton, or corn) and pecan orchards exist.

Important Species. "Important" species are defined as those that (a) are commercially or recreationally valuable, (b) are threatened or endangered, (c) affect the well-being of some important species within criteria (a) or (b), or (d) are critical to the structure and function of the ecological system or are biological indicators.

Threatened and Endangered Species. No Louisiana plant species are listed or proposed by the FWS as threatened or endangered (45 FR (242):82480-82569). Information concerning rare and endangered species has recently been updated by the FWS. Eight plant species that are of potential occurrence in the permit area are listed by the FWS, as "under review." Three of these species are also listed by the Louisiana Forestry Commission (1977) as rare. Table 4-17 in the Draft EIS for the proposed power plant (EPA, 1981) presents scientific names, common names, distributions, and status categories for these species. None of these species were observed nor are known to occur in the proposed Dolet Hills mine permit area.

Other Important Species. The most commercially important plant species in the permit area are the loblolly and shortleaf pines occurring both in uneven-aged pine/hardwood stands and even-aged pine plantations as discussed above. Though underutilized at present, marketable hardwoods in the permit area are potentially significant as commercial species. Common and coastal bermuda grass and bahia grass are the most important forage species planted in the pastures within the permit area. Domestic gardens and row crops (chiefly watermelons and corn) are of limited importance. The economic value of these commercially important plant species is discussed in Section 5.8.4.

Dominant species are, by definition, critical to the structure and function of the ecological system and, therefore, qualify as important species under criterion (d). The dominant species in the permit area include a number of trees and a few herbs, as discussed previously. Plant species important as browse or forage materials for wildlife in the permit area qualify as important species under three different criteria: (a), (c), and (d). Browse and forage plants include Japanese honeysuckle, rattan-vine (Berchemia scandens), dewberry and blackberry (Rubus spp.), hawthorn, willow oak, farkleberry (Vaccinium arboreum), post oak, St. Andrew's cross (Ascyrum hypericoides), American beautyberry, trumpet-creeper (Campsis radicans), deciduous holly (Ilex decidua), yaupon (Ilex vomitoria), and green-brier (Smilax spp.). Of special importance to deer is oak mast (Quercus spp.) (Alexander, 1976; Lowery 1974).

The importance of the permit area in terms of wildlife habitat varies from one plant community to another. Pine plantations offer little in the way of plant species or structural diversities. The understory in mature bottomland hardwood stands is usually quite shady and, hence, depauperate in forage and browse plants. The overstory is structurally diverse, however, and a relatively large number of bird species occur there. In immature or disturbed bottomland stands, herbs, shrubs, and saplings are usually abundant and offer a variety of food sources for wildlife. The same is true of the edges of most forested stands.

Upland oak/hickory/pine stands within the permit area offer the most diversity in understory and overstory plant species in terms of available wildlife food and structural characteristics. These greater structural and species diversities provide habitat for a correspondingly greater number of wildlife species.

Grasslands within the permit area are mainly coastal bermuda grass and bahia grass pastures. Such pastures lack the cover necessary for good wildlife habitat, but are used sporadically for forage. The oldfields, however, do provide good wildlife cover, especially for birds and small mammals.

Ecologically Sensitive Areas. There are no plant communities within the permit area unique to the area. Similar vegetation occurs in the area contiguous to the permit area as well as throughout northwestern Louisiana and the Oak-Pine Forest Region (Braun, 1950) of the southeastern United States. Little, if any, of the vegetation of the permit area is undisturbed; nearly all of the existing forest has been subjected to logging or clear-cutting within the past 50 to 60 years. The possible exceptions are a few small stands that occur on mesic slopes along streams or in lowlands, where a few trees are well over 100 years old. Beech stands, which represent the most mature vegetation on the permit area, are of interest because of the importance of beech in the theoretical climax forest of the Gulf Coastal Plain.

Hydric habitats (i.e., swamps, marshes, bogs, and other hydric habitats) and bottomland hardwood forests in the permit area would be considered ecologically sensitive due to their high productivity, their dependence upon certain hydrologic factors, and their high susceptibility to potential project impacts such as sedimentation. Approximately 102.3 hectares (253 acres), including Louies Brake in the eastern portion of the permit area, comprise the most sensitive portions of these two vegetational communities due to their delineation as wetlands under the jurisdiction of the USCE (see Section 6.2.1).

Portions of both the mesic cove and bottomland forest types in the permit area contain plant species that Kral (1966) views as indicators of a Pleistocene relict flora uncommon in Louisiana. In addition, many of the 191 species of vascular plants associated with the mesic slope and bog forests were not associated with other plant communities on the permit area.

5.5.1.2 Effects of No Action

The no-action alternative would eliminate the adverse impacts of construction and operation related to the proposed Dolet Hills Lignite Mine Project. In the absence of the project, changes in the terrestrial vegetation could be expected if current trends continue. In many portions of the lignite belt in northwestern Louisiana, both upland and bottomland forest and shrub communities are being converted either to managed pine forest/plantation or pastureland or row cropland. Plant successional patterns are being complicated by the introduction of grasses and legumes for improved pastures. These ongoing adverse impacts to terrestrial vegetation generally result in reduced plant species diversity and less native, natural vegetation.

5.5.1.3 Construction Impacts

Site preparation and construction activities within the proposed permit area will adversely impact those portions of the ancillary area where offices, roads, dragline erection pads, surface water control structures, powerlines, service structures, and the various pipeline and highway relocations will be constructed.

Construction of the various mine ancillary facilities will remove vegetation from a portion of the 5,709.1-hectare (14,107-acre) ancillary area (see Table 5-13). The construction of service structures, roads, conveyors, and dragline erection pads will remove vegetation from approximately 72.8, 70.8, 65.5, and 4.4 hectares (180, 175, 162, and 11 acres), respectively. One hundred and seven temporary and nine permanent sedimentation ponds will remove vegetation primarily within the mine ancillary area. Temporary sedimentation ponds, with an average size of 3.6 hectares (8.8 acres), will cause a direct, short-term impact to vegetation by preempting 383.3 hectares (946.5 acres) in both mine and mine ancillary areas, approximately 80 percent of which presently supports upland pine/hardwood forest and bottomland hardwood forest, with the rest supporting regeneration/cutover and grassland. Permanent sedimentation ponds, which vary greatly in size, will preempt an additional 38.3 hectares (94.5 acres) solely within the mine area, resulting in a long-term adverse impact to the existing vegetation. Ninety-four percent of the land preempted by permanent sedimentation ponds presently supports upland pine/hardwood and bottomland hardwood forest. In addition, approximately 253 hectares (625 acres) within the ancillary area will be disturbed by the construction of transmission lines, stream diversions, and various pipeline and highway relocations. Vegetation loss due to permanent and temporary stream diversions (outside mining blocks, but within the permit area) will result in long-term adverse impacts to 3.7 hectares (9.2 acres) of bottomland hardwood forest; 2.5 hectares (6.1 acres) of grassland, 2.4 hectares (5.9 acres) of regeneration cutover areas, and 2.7 hectares (6.6 acres) of upland pine forest. The streams to be permanently diverted are Chatman Bayou, Tenmile Bayou, Louies Bayou, and Prairie Bayou. Some of the ancillary facilities will be maintained for the life of the mine (32 years) or longer and, therefore, represent a relatively long-term adverse impact resulting from removal of existing vegetation. Delineated wetlands under USCE jurisdiction may be directly and indirectly impacted adversely by site preparation and construction activities in the ancillary areas (see Figure 4-6b). Besides the direct impacts related to clearing operations, pollutants such as oil and grease found in runoff from haul roads, haul trucks, and other vehicles may have adverse effects on terrestrial vegetation of a short-term localized nature. In addition, approximately 5,059 hectares (12,500 acres) of the ancillary area not directly impacted by site preparation and construction activities delineated above may be indirectly and adversely impacted.

Site preparation and construction may produce some unavoidable adverse impacts to vegetation left standing adjacent to cleared areas. The construction of erosion control structures such as sedimentation ponds prior to other site preparation and construction activities may result in localized short-term adverse impacts to either downstream or adjacent plant communities due to erosion and/or sedimentation. Commonly accepted erosion control structures, located as close to potential sediment sources as possible, will minimize the short-term adverse impacts of erosion and/or sedimentation from subsequent site preparation and construction activities. Also, primary production in vegetation immediately adjacent to construction sites may be reduced due to dust accumulation on foliage. Several dust suppression measures will be incorporated during construction activities to further reduce the release of fugitive emissions into the atmosphere. Such measures will include the spraying of roads and disturbed areas by water trucks, as needed, and the control of vehicle speeds along roads.

5.5.1.4 Operations Impacts

Impacts upon terrestrial vegetation within the proposed Dolet Hills Lignite Mine Project during operations will include the removal of natural vegetation in those portions of the mine area to be mined and the alteration of physical and chemical variables that affect an ecological balance in both adjacent and downstream biotic communities.

During the life of the mine (32 years), approximately 6,259 hectares (15,466 acres) of primarily upland forest, grassland, and regeneration/cutover areas will be cleared prior to actual mining activities (Table 5-13). An average of 195.4 hectares (483 acres) will be cleared annually prior to mining during the 32-year life of the mine, with an average of 280.4 hectares (693 acres) cleared annually during the period of full lignite production (1993-2017). All merchantable timber will be sold and removed prior to overburden removal. Thereafter, the remaining vegetation and other refuse will be removed by bulldozers, pushed into piles or windrows, and disposed of or burned in accordance with the regulations of the Louisiana Air Quality Division. This will be a continuous operation in advance of the overburden removal to minimize the amount of disturbed area as mining progresses. The premining clearing will proceed incrementally over a span of 32 years and will be followed by postmining reclamation. The direct, adverse impacts to vegetation from premining clearing are considered to be long-term.

Mining will occur progressively, with unreclaimed, disturbed land averaging 367.8 hectares (909 acres) during the 32-year life of the mine, with a maximum of 485.6 hectares (1,200 acres) of unreclaimed, disturbed land occurring from the year 2001 to the year

2008. Approximately 102.3 hectares (253 acres) of delineated wetlands under the jurisdiction of the USCE occur in the permit area. Approximately 6 hectares (15 acres) will be directly and adversely impacted by mining operations; the rest may be indirectly and adversely impacted by ancillary activities. Mining of the wetlands will occur around the years 1987-1990.

Since sedimentation is potentially the most adverse impact to offsite areas of clearing activities, erosion will be minimized by locating commonly accepted structures as close to the sediment source as possible prior to the initiation of clearing and grubbing operations. Erosion control structures will include stream diversions, sedimentation ponds, hay-bale barriers, catchment basins, and overland flow-interceptor channels. As described below in the discussion of reclamation plans, erosion and associated adverse impacts on down stream plant communities will be further minimized by the establishment of a vegetative cover on areas disturbed by clearing as soon as feasible. During mining operations, the adverse impacts of sedimentation on surface- and ground-water regimes in adjacent floodplains due to the ongoing construction of surface water control structures will be periodic and short-term; therefore, water-related adverse impacts to vegetation in the floodplains adjacent to the mine area due to the construction of such structures should be minor.

The mining activity of men and machinery, along with associated dust, will have unavoidable minor, adverse impacts on immediately adjacent terrestrial vegetation in the project area. Land clearing, mining operations, and traffic will create wind-blown particulates of both soil and lignite, which will accumulate to some extent on foliage surfaces in areas immediately adjacent to these activities. However, these unavoidable adverse impacts should be short-term and localized because the total amount of area affected at any time will be relatively small. Road surfaces will be sprayed with water as needed and reclamation will immediately follow mining.

Projected operational changes to the topography within proposed mine areas (i.e., smoothing of existing surface features and slight increase in surface elevation), in addition to devegetating those areas, tend to increase surface runoff velocity from the slopes into adjacent bottomlands, causing increased erosion and sedimentation. Proper use of erosion control structures will prevent increased sedimentation in the bottomlands in the mine area, which, if not prevented, could result in the desiccation of existing hydric habitats because of increased elevations in those areas. The operation of surface water control structures, however, may result in a reduction of water inflow to forested and nonforested hydric habitats in the permit area which are dependent upon these drainages. Reduced water flow would have an adverse impact on these vegetational communities since it may interfere with nutrient regeneration, a process upon which the productivity of hydric habitats depends (Darnell, 1976). The lowering of the water table along drainage structures may produce adverse impacts in the form of localized reductions in available soil moisture. Such desiccation effects would be most noticeable in hydric habitats in the mine area, where the plants are highly sensitive to changes in soil moisture levels (Darnell, 1976). On the other hand, a long-term positive impact may result in that hydric habitat could be established in areas where surface water is retained along diversion ditches and within local depressions lacking drainage. However, the areal extent of hydric habitats so created is unknown.

Adverse impacts to vegetation will result from the general lowering of ground-water levels due to dewatering and/or depressurization during the operational phase (see Section 5.2.1.4). A decrease of ground-water discharge into surface streams from seeps and springs, and a possible increase in induced infiltration of surface water into the ground-water system will occur. Ground-water discharge will be further reduced by diversion of streams around reclaimed areas and away from former recharge points. In addition, springs and seeps which formerly were dependent on recharge from the mine area will become more intermittent after mining, since the major source of recharge over most of the postmine area will be the infiltration of precipitation (Section 5.2.1.4). Local lowering of surface-water levels in hydric habitats will be dependent upon the distance of such habitats from excavation activities. The vegetational communities to be most adversely impacted by the disruption of recharge to streams and seeps and lowering of ground-water levels will be hillside bogs, riparian communities, and downstream hydric habitats that are dependent on discharge from streams and seeps in the mine area. It is anticipated that hillside seepage bogs will be most adversely impacted due to their dependence upon continuously saturated soils. No ground-water impacts to hydric habitats in adjacent floodplains that are not hydrologically dependent upon proposed mine areas are expected, since the normal flow and seasonal flooding of major adjacent drainages will not be impeded. However, even minor changes to the water input may be detrimental to hydric habitats and USCE-designated wetlands.

The reclamation plans provide for approximate reconstruction of premining block contours, soil preparation, establishment of vigorous ground cover, and proper management of vegetation following establishment. In addition to the control structures described previously, erosion control prior to the establishment of a permanent vegetative cover will include temporary cover crops and mulching. Vegetation establishment will be aided by use of equipment (e.g., hydroseeders) which can apply seed, mulch, binder, and amendments in the same operation, or by using other acceptable equipment. Adverse impacts to terrestrial vegetation during reclamation activities may result from earth moving, use and removal of haul roads, application of lime and fertilizers, seeding, and planting of trees. The short-term effects arising from these operations would include increased fugitive dust emission and downstream water degradation.

The temporal nature of postmining habitat restoration will vary, depending on the type of plant community preempted and the success of the reclamation plan. Postmining habitats within the 11,968-hectare (29,573-acre) permit area will consist of approximately 88 percent of managed and unmanaged forest (10,523 hectares; 26,023 acres), 10 percent of improved pasture seeded with species such as crimson clover (Trifolium incarnatum), ryegrass (Lolium perenne), bahiagrass, and/or common bermudagrass (1,192 hectares; 2,946 acres), 1.8 percent of wildlife habitat (214 hectares; 530 acres), and approximately 0.2 percent of developed water resources including permanent sedimentation ponds and livestock and wildlife watering ponds (30 hectares; 74 acres). Areas within the mined area that are restored to forest will be primarily commercial pine. Therefore, the postmining vegetational communities differ significantly from the premining vegetational communities, which are overwhelmingly dominated by native, natural forests and cutover/regeneration areas (Table 5-13, Section 5.5.1.1). Although pine plantations and improved pastures contain ecologically complex communities of soil micoorganisms and intricate chemical balances that influence productivity, these agricultural systems are relatively simple with regard to both floral and faunal diversity when compared with natural ecosystems such as forests or hydric habitats. Species diversity and structural complexity will be somewhat enhanced in reclaimed pine plantations and wildlife habitat areas, at least with respect to common species, by the planting of hardwoods and other species valuable to wildlife. One-acre wildlife habitat areas, planted with blackberry (Rubus spp.), wax myrtle, flowering dogwood (Cornus florida), fringe tree (Chionanthus virginica) and other species, will be interspersed approximately every 8-10 hectares (20-25 acres) in reclaimed areas other than commercial forests specific to lease agreements, where possible. Also, woody species of high value to wildlife, such as southern arrow-wood (Viburnum dentatum), amur honeysuckle (Lonicera maackii), black cherry (Prunus serotina), sawtooth oak (Quercus acutissima), and blackgum, will be interspersed throughout reclaimed pine plantations, where possible. Wildlife habitat areas created around ponds and stream diversions will include water oak, Nuttall oak (Quercus nuttalli), Shumard red oak (Q. shumardii), and bald cypress.

In natural communities, species diversity is directly correlated with habitat variability. Variability of and discontinuity in topography and subsurface features are necessary to allow development of diverse communities, such as bogs and their unique flora adjacent to seepages. As a result of general reconstruction of the surface contours of the land, along with the natural influences of wind, water erosion and biotic factors, some habitat diversity should eventually become established. Postmining habitat diversity will be enhanced by the nine permanent sedimentation ponds which will be constructed, where possible, with irregular shorelines and shallow littoral zones for the establishment of rooted vegetation. Also, reclamation will establish small livestock or wildlife water ponds at appropriate intervals throughout the postmining area.

Since mining and reclamation will proceed sequentially, the adverse impacts on upland habitats preemption by mining are generally considered to be short-term. Adverse long-term impacts will result from the mining of approximately 317 hectares (783 acres) presently supporting relatively mature, diverse communities of bottomland forests. Reestablishment of bottomland communities, even after contouring and revegetation, will be largely dependent on natural succession and will require many years. However, some micro- communities, such as bogs, which are dependent on local hillside seeps, will have a low probability of reestablishment.

5.5.1.5 Combined Impacts of Power Plant and Mine.

Vegetation to be preempted by the construction of both the power plant and mine facilities will be converted to industrial use for the life of the project (35 years). About 650.8 hectares (1,608 acres) within the power plant site and transportive systems, and approximately 253 hectares (625 acres) of the 5,709.1-hectare (14,107-acre) ancillary area occupied by mine facilities will be removed from existing vegetation for the life of the project. An additional 6,259 hectares (15,466 acres) in the mine area will be disturbed incrementally over the life of the project.

5.5.2 Wildlife

5.5.2.1 Existing Environment

The Dolet Hills Lignite Mine Project area lies within the Austroriparian Biotic Province, which extends from the piney woods of eastern Texas through the southeastern United States to the Atlantic Ocean (Dice, 1943). This biotic province is characterized by extensive forests of pines and hardwoods and by numerous swamps, marshes, and other wetlands. The project area is located within the western portion of the Austroriparian in a vegetational area referred to as the Oak-Pine Forest Region (Braun, 1950). The plant communities (and thus wildlife habitats) of the project area are generally typical of other parts of the Austroriparian.

The vertebrate fauna of the permit area is also generally typical of that occurring over most of the Austroriparian Biotic Province. As would be expected, the majority of the wildlife species are upland forest- or bottomland-associated. The mammalian fauna of the project area contains no endemic species. Likewise, the herpetofauna contains no species restricted to that area; however, two subspecies with limited ranges, the uncommon Louisiana Pine Snake (*Pituophis melanoleucus ruthveni*) and the common Buttermilk Snake (*Coluber constrictor anthicus*), are characteristic of habitats found within the project vicinity.

Existing wildlife resources of the proposed permit area and surrounding environs are described in baseline studies conducted in 1979 and 1980 (EH&A, 1980c) and in the Draft EIS for the proposed Dolet Hills Power Plant (EPA, 1981). The following sections present brief summaries of the wildlife information from these two reports. Scientific names for wildlife species can be found in EH&A, 1980c.

Wildlife Habitats and Characteristic Wildlife Species. The wildlife habitats of the permit area can be divided into major types coinciding closely with the vegetation communities previously described in Section 5.5.1.

Upland pine-hardwood forest is the most widespread wildlife habitat in the permit area. Since the major land use in upland forest is logging, the stage of vegetational succession in this habitat at any given location depends on how recently the area has been logged and on the type of logging that has occurred (e.g., clear cutting, selective cutting, seed tree regeneration, post- and pole-logging). Some of the most advanced successional stages occur in areas protected somewhat from logging because of the hilly terrain. The earliest successional stages are found where recent clear cutting has occurred. The faunal diversity and species composition change in relation to the structure and floral species composition of the forest. In early stages, common wildlife species often include the Yellow-breasted Chat, Prairie Warbler, White-eyed Vireo, Hispid Cotton Rat, Fulvous Harvest Mouse, and Texas Rat Snake. Older stands of pines and hardwood support species such as the Pine Warbler, Black-and-white Warbler, Tufted Titmouse, Cardinal, Golden Mouse, White-footed Mouse, Virginia Opossum, Fox Squirrel, Buttermilk Snake, Southern Copperhead, and Woodhouse's Toad.

Bottomland forest and small swamps are found in the lowland areas associated with the floodplains of streams, creeks, and other drainages in the permit area. These areas represent the most important wildlife habitat in the permit area due to the high density and diversity of wildlife species dependent on them and also due to the continuing reduction in areal extent of these habitats. Wildlife species characterizing the bottomlands and/or swamps include the Gray Squirrel, White-tailed Deer, Swamp Rabbit, Cotton Mouse, Raccoon, Prothonotary Warbler, Parula Warbler, Barred Owl, Pileated Woodpecker, Wood Thrush, Southern Copperhead, Five-lined Skink, Gray Treefrog, and Three-toed Box Turtle.

Aquatic habitats in the permit area include Blanchard Bayou, Dolet Bayou, Cave Branch, Dead Negro Bayou, and other drainages, as well as several man-made farm ponds and natural bogs. These habitat types are important to a large diversity of wildlife species, and important species like the American Alligator, Raccoon, Beaver, Mink, and several species of waterfowl could potentially occur. Other wildlife species closely associated with aquatic habitats of the region include the Marsh Rice Rat, Belted Kingfisher, Great Blue Heron, Northern Cricket Frog, Bullfrog, Bronze Frog, Red-eared Slider, Yellowbelly Water Snake, and Western Cottonmouth.

Open grassland habitats in the permit area include oldfields, pastures, and other open areas where trees are few in number or entirely absent. Like the upland forest, this habitat varies in relation to current land use practices. Common wildlife species of the open habitats include the American Kestrel, Bobwhite, Common Crow, Eastern Meadowlark, White-throated Sparrow, Fulvous Harvest Mouse, Eastern Cottontail, Texas Rat Snake, and Texas Brown Snake.

Wildlife Species. Of the 82 species of reptiles and amphibians whose geographic range includes the permit area, 30 (36 percent) were observed during field surveys (EH&A, 1980c). These species are mostly typical Austroriparian forest- or aquatic-associated forms, the most common of which included the Gray Treefrog, Bronze Frog, Southern Leopard Frog, Northern Cricket Frog, Yellowbelly Water Snake, Broad-banded Water Snake, Western Cottonmouth, Red-eared Slider, and numerous others.

Field surveys also indicated the bird life of the permit area was typical of that in other areas of northwestern Louisiana. At the time of the survey, avian species in appropriate habitat of the area included the Red-winged Blackbird, Bobwhite, Cardinal, Carolina Wren, Acadian Flycatcher, Prothonotary Warbler, Red-eyed Vireo, Hooded Warbler, Blue-gray Gnatcatcher, White-eyed Vireo, Tufted Titmouse, Prairie Warbler, Yellow-breasted Chat, Indigo Bunting, and Red-headed Woodpecker. Spring density estimates were greatest for the bottomland forest (375.6 birds/40.4 hectares (100 acres)) followed by mature upland pine-hardwood forest (318.8 birds/40.4 hectares (100 acres)) and second-growth forest (259.0 birds/40.4 hectares (100 acres)). Diversity of breeding birds was greatest in the second-growth upland forest, followed by the pine-hardwood forest and the bottomland forest.

The most common species of mammals observed in the permit area included the Gray Squirrel, Fox Squirrel, Cotton Mouse, Hispid Cotton Rat, Golden Mouse, Raccoon, Swamp Rabbit, Eastern Cottontail, Fulvous Harvest Mouse, Nine-banded Armadillo, Striped Skunk, and Virginia Opossum. Small mammal trapping in the project area resulted in the capture of eight species (EH&A, 1980c). The most successful trapping occurred in the upland pine-hardwood forest (11.1 percent), where four species, including a Woodland Vole, were captured. The highest diversity of small mammals was captured in the second-growth upland forest and pine-hardwood forest (four species each). The Golden Mouse was captured in the greatest variety of habitats.

Important Species. As stated in Sec. 5.5.1.1, "Important species" are defined as those that (1) are commercially or recreationally valuable; (2) are threatened or endangered; (3) are critical to the survival of a species satisfying criterion (1) or (2); or (4) are critical to the structure or function of the ecosystem or are biological indicators.

Commercially or Recreationally Valuable Species. Several species of mammals and birds are hunted in the area and, therefore, represent an important recreational and economic resource. The White-tailed Deer is the most important big game mammal in the area, while the Wild Turkey, Bobwhite, and Mourning Dove are important game birds. The Fox Squirrel and Gray Squirrel are important small game mammals throughout the state. The Eastern Cottontail and Swamp Rabbit, although not strictly defined as game animals, are hunted throughout Louisiana.

Descriptions of these species, their habitats, and population data for the project area are presented in the Dolet Hills Power Plant Draft EIS (EPA, 1981) and in baseline studies conducted which included the mine site (EH&A, 1980c).

Furbearers have a major economic and recreational importance in Louisiana. In fact, Lowery (1974) reported Louisiana as the leading fur-producing state on the North American continent. For the fur season 1972-73, over two million pelts were harvested with a value of almost $10 million. The Raccoon, Virginia Opossum, and Striped Skunk appeared to be the most common furbearers in the permit area.

Data available indicate that populations of game and furbearing species in the permit area are typical of similar habitats in northwest Louisiana. Bottomland habitats in the area and region represent the best habitats for these species. Such habitats represent a relatively small percent (6.9%) of the permit area.

Threatened and Endangered Species. Three species of terrestrial vertebrates considered endangered by the U.S. Department of the Interior (50 CFR 17.11 & 17.12) have a geographic range that includes the permit area. These are the Red-cockaded Woodpecker (Picoides borealis), Bald Eagle (Haliaeetus leucocephalus), and Peregrine Falcon (Falco peregrinus).

On 21 July 1982, EPA requested that the U.S. Fish and Wildlife Service (FWS) provide a list of threatened and endangered species that may occur within the project vicinity. FWS responded on 3 August 1982 that the Red-cockaded Woodpecker may occur in the project area and that a Biological Assessment addressing project impacts to this listed species will be required (see Section 6.2.2). Jackson (1971) found no recent (1960-1970) records of the Red-cockaded Woodpecker in De Soto Parish but reported them for the parish in a later publication (Jackson, 1978). Recently a few sightings of the species or possible signs have been reported, one from the northern border of the parish and one from a site north of the permit area (Jeter, 1979; EH&A, in-house data). Field surveys of the permit area did not result in any observations of their preferred habitat (i.e., overmature open pine forest) and it is doubtful that any such areas exist on the site. A Biological Assessment has been prepared by EPA to consider the effects of the proposed surface lignite mine on the Red-cockaded Woodpecker. As a result of this assessment, EPA determined that there is "no effect" on the Red-cockaded Woodpecker. This determination has been provided to the FWS (Jackson, Mississippi) for their review and biological opinion.

5.5.2.2 Effects of No Action

The no action alternative would eliminate the adverse impacts of construction and operation related to the proposed project. In the absence of the proposed Dolet Hills Lignite Mine Project, the area would probably remain largely in its present state with lumbering of marketable timber being the predominant activity affecting wildlife. As individual land ownership changes and lands are passed along to new owners, land use practices on those and other lands may or may not change but it is unlikely that any given factor will create a drastic broad scale change in the entire permit area within a short time period.

5.5.2.3 Construction Impacts

The primary direct adverse impact of construction activities related to the proposed lignite mine on wildlife will be the result of the previously discussed vegetation clearing (Section 5.4.3) and associated habitat disturbances. Clearing activities in the ancillary area will result in the direct destruction of some forms of wildlife that are not mobile enough to avoid construction operations. These include species of small amphibians, reptiles, mammals, and some age classes of birds (e.g., nestlings and fledglings). Larger, more mobile species of wildlife may avoid the initial clearing activity and in-migrate into adjacent habitats. However, each species of animal is dependent on available resources such as food, shelter, water, territory, and nesting sites from its habitat, and any given area of habitat will have a certain amount of these resources (Dempster, 1975). The carrying capacity of a habitat for a species is determined by the availability of these resources and, in particular, the availability of critical limiting resources. Unless data are available to the contrary, it is assumed for the purposes of impacts analysis that these habitats are at their carrying capacity for the species that live there. Thus, where new individuals are forced into competition with resident individuals, competition for resources will occur, eventually resulting in decreased productivity and/or increased mortality such that populations are reduced to that which the habitat can support (Dempster, 1975). This will result in an indirect adverse impact on wildlife populations adjacent to construction areas.

Based upon field investigations (EH&A, 1980c), the permit area supports diverse and substantial populations of birds, reptiles, amphibians, and mammals. Construction activities within the 5709.1-hectare (14,107-acre) ancillary zone will directly affect approximately 253 hectares (625 acres) of wildlife habitat, resulting in direct adverse impacts of construction on wildlife populations. Also, the predominant wildlife habitat type to be affected by clearing activities is upland forest, which is the most common and widespread habitat in the permit area and which supports species such as the Pine Warbler, Cardinal, Virginia Opossum, Fox Squirrel, Golden Mouse, and other typical forest species. Direct impacts of clearing in the ancillary areas may be considered long-term due to the fact that such areas will remain cleared for the life of the mine (32 years) or longer. Indirect adverse impacts resulting from competition between in-migrating and resident wildlife populations will be short-term, lasting up to approximately 5 years.

Increased noise in the permit area could potentially disturb breeding or other activities of species that inhabit the adjacent areas; however, methods for quantifying such potential impacts are not yet developed (Janssen, 1978). Shaw (1978) states that "Information about the effects of noise on wildlife is widely scattered through the scientific literature, frequently inconclusive, and sometimes contradictory." However, studies indicate that many wildlife species learn to avoid sounds which are associated with danger (such as the sound of airplanes used to chase wolves, caribou, etc.), and that many species habituate to loud environmental noise pollution which does not result in physical harm (Bushel, 1978; Lynch and Speake, 1978; and Thiessen et al., 1957). In any case, the adverse effects of construction noise will be relatively short-term in nature and limited with regard to areal extent.

An increase in hunting is likely to result from the concentration of construction workers and the greater accessibility to the permit area; however, the extent to which this will impact the wildlife is not easily quantified. Game species and furbearers would receive the greatest pressure in this regard although state hunting regulations should prevent undue impacts.

5.5.2.4 Operation Impacts

Clearing of the mining blocks will occur throughout the 32-year life of the mine and will take place a few hundred feet in simultaneous advance of the operating draglines. Thus, even though the mining blocks encompass 6,259 hectares (15,466 acres), the actual area in which clearing is ongoing will be much smaller. The adverse impacts to wildlife during clearing will be of the same nature as those discussed in the previous section on construction. However, the magnitude of both direct and indirect adverse impacts resulting from clearing during the operational phase of the mine will be much greater due to the larger area to be affected. Habitats which will be cleared include 4977.9 hectares (12,300.1 acres) of upland forest, 317.0 hectares (783.3 acres) of bottomland forest, 13.6 hectares (33.6 acres) of aquatic and wetland habitats, and 950.6 hectares (2349.0 acres) of grassland habitats. Wildlife species that will be adversely affected by this clearing include those species previously discussed in Section 5.5.2.1 as being typical of those habitats.

The type of wildlife species which will inhabit the mined area and the structure, diversity and dynamics of the wildlife communities will depend to a major extent on the practical application of the reclamation plan (including fish and wildlife measures) and on postmining land use. Based on the reclamation plans, the postmining fauna of the mined area will greatly differ in species composition and community structure from the existing wildlife communities. Numerous studies have documented similar adverse impacts on strip mined areas (e.g., Cantle, 1978; Brewer, 1958; Karr, 1969; Allaise, 1979; Wray et al., 1982).

Electrocution of raptors appears to be a greater problem in the Western States (Miller et al., 1975) and where natural perches are not available. The exact voltage requirements for the mining operations have not been finally established. It is anticipated that a kilometer (10-mile) long electric transmission line will be required to bring power into the mine area. This will serve as a main line from which smaller droplines will be built to serve specific mining locations. These small droplines will be approximately 2-11 kilometers (1-7 miles) in length, depending on the stage of the mining sequence. The larger main transmission line will be either 34.5 kV, 69 kV or 138 kV. If the line is 34.5 kV or 69 kV, single wood pole structures will be used. A 138 kV line would likely require wooden H-frame structures. If it is determined that raptors may utilize project transmission lines rather than natural perches in the forested vicinity, application practices suggested by Olendorff et al. (1981) for raptor protection will be followed.

Reclamation of the mine blocks on the Dolet Hills Lignite Mine Project will begin immediately following the replacement of the overburden. Reclaimed pasture will be established with crimson clover, ryegrass, bahiagrass and/or common bermudagrass. These species will create an open habitat that may be compared to croplands or pasturelands with respect to wildlife value. Such habitats support a very low diversity and an overall low density of wildlife, although a few species may occur there in good numbers (e.g., Brown-headed Cowbirds, Killdeer, and Eastern Meadowlarks). Ten percent of the mined area will be reclaimed as improved pasture (Camp, 1982), and as such will have little value to wildlife.

Eighty-eight percent of the postmining land use of the mined area will be managed and unmanaged upland forest. Thus, following soil stabilization in such areas, pine trees will be planted and a long-term succession will begin toward the development of pine forests. However, because of the monoculture nature of these forests, their wildlife value is likely to be extremely limited. Species which may utilize these areas will change over the 30 to 50 years before timber clearing occurs again. Intermediate stages, before the growing pines shade out and eliminate the ground layer herbaceous species, are likely to attract the greatest number of wildlife species though much fewer than a "natural" regeneration forest. It is at this time that the habitat will offer the greatest variety of vegetational resources. Subsequent cuttings (perhaps 80-100 years after reclamation) of the forest should be followed by more vegetationally diverse intermediate stages which are of greater value than the initial reclamation plantings.

Once the pine canopy dominates the habitat, the wildlife value of the reclaimed pine forest will fall significantly. This habitat will be characterized by little ground cover except pine needles and a monoculture overstory which provides neither a diversity nor good quantity of wildlife foods or cover. Some species such as the Pine Warbler, Yellow-rumped Warbler, Ruby-crowned Kinglet, Carolina Chickadee, and others may be fairly common; however, most woodland species require greater structural and species diversity. Many woodland species that currently inhabit portions of the mine blocks (e.g., Prothonotary Warbler, Parula Warbler, Gray Squirrel, Pileated Woodpecker, Great-crested Flycatcher, Wood Thrush, and others) will be either totally excluded or greatly limited in such areas. Population studies such as those by Dickson and Segelguist (1979), Dickson et al. (1980), Dickson (1978), and Meyers and Johnson (1978) support this opinion. In the case of strip-mining, the differences between the reclaimed forest and "natural" forest will be even greater due to the removal of seeds and roots which increase the diversity of plants in early and late seral stages.

Fish and wildlife habitat (specifically designated) and developed water resources are to represent 1.8 percent and 0.2 percent, respectively, of the postmining land use in the permit area. These areas offer the greatest opportunity for providing habitat for many species which would not otherwise occur in the permit area. Fish and wildlife areas will represent .4 hectare (1 acre) for each 8-10.1 hectares (20-25 acres) of reclaimed land that is not specifically designated for commercial pine forests through lease agreements. These will be planted with tree and shrub species that are preferred for wildlife food and cover (see Section 4.4.5.2). Fish and wildlife areas will also be established where appropriate along fence rows, pipeline corridors, transmission line corridors, roads, or other suitable areas. In addition, fish and wildlife habitat is to be established around postmining ponds and adjacent to diverted streams. Most diverted streams will be replaced in more or less a straight channel; however, some channel meanders and intermittent pool and riffle areas will be constructed. Ponds will be constructed with shallow littoral zones and with maximum shoreline to benefit various wildlife species.

In conclusion, successful reclamation efforts can reduce adverse impacts on wildlife to some extent; however, habitats such as mature pine-beech forest, swamps and bottom lands will not be replaced. The commercial pine forest may eventually approach the value of some such areas currently existing in the permit area; however, the overall diversity (both in terms of plants and wildlife) in the upland forest will be greatly reduced. Due to the large area involved, the operation of the Dolet Hills Lignite Mine will result in a major adverse long-term impact on the wildlife resources of the area. The regional effects of this adverse impact are discussed in Section 5.9.

5.5.2.5 Combined Impacts of Power Plant and Mine

As described previously in Section 5.5.1.5, construction of the power plant and mine facilities will result in the preemption of 715.5 hectares (1,768 acres) and approximately 253 hectares (625 acres), respectively, of vegetation and thus wildlife habitats. Because the areas affected will be converted to industrial use for the 35-year life of the project, this adverse impact on wildlife is considered long-term. Actual mining will result in the preemption of 6,259 hectares (15,466 acres) of wildlife habitat incrementally over the life of the project. This adverse impact will result in long-term effects on wildlife species and communities due to substantial changes in species composition and community dynamics. Reclamation will reduce adverse impacts of mining to some extent; however, certain habitats such as mature upland forest and bottomland forest will probably not redevelop for many years, if at all. The overall value of mined areas to wildlife will be greatly reduced.

Other adverse impacts on wildlife as a result of construction and operation of the power plant and mine include the affects of noise, increased human activity in the area, dust, and other similar impacts as described previously for the mine and as discussed in the Final Environmental Impact Statement for the Dolet Hills Power Plant (EPA, 1982). These impacts are mostly short-term in nature and limited with regard to the areal extent of affected habitats.

5.5.3 Aquatic Ecology

5.5.3.1 Existing Environment

The following discussions are based on a year-long, bimonthly field program (July, 1979 through May, 1980) that concentrated on the major streams of the permit area and vicinity. In order to select stations for this survey and obtain a general assessment of aquatic habitats and biota in the project area, two reconnaissance surveys were conducted in April and May, 1979 (EH&A, 1980c).

Aquatic Habitats. Aquatic environments in the permit area and vicinity include perennial streams, intermittent creeks, swamps, marshes, and impoundments. All of the larger streams, except Chatman and Tenmile bayous, drain in a southeasterly direction toward the Red River. The two streams mentioned above are tributaries of Bayou San Patricio, which is part of the Sabine River drainage system. Marsh areas on the permit site are relatively rare, with most only intermittently flooded. Swamps, characterized by a cypress canopy and a low diversity of other aquatic vegetation, are more common. These areas are described in the vegetation section (Section 5.5.1). Impoundment (i.e., stock tank) habitats are not common within the project site. They are typically shallow, mud-bottomed ponds containing dense stands of aquatic vegetation.

Surface waters of the general project area are generally characterized by moderate conductivity (and dissolved solids content), circumneutral to slightly acidic pH, and variable dissolved oxygen (DO) concentrations.

Most of the stream channels and swamp areas of the region are heavily shaded by riparian vegetation, which precludes the extensive development of either vascular aquatic vegetation or algal communities, and provides large inputs of terrestrial plant debris. These conditions result in relatively low levels of primary production coupled with high oxygen demand, particularly during summer periods of low flow and high water temperatures. DO concentrations are generally below saturation in these environments, and may be expected to fall to very low levels (less than 3 mg/l) during warm periods.

The substrate of these aquatic systems are typically composed of clay, with varying admixtures of silt, sand, and gravel, commonly ranging from soft, anaerobic muds in swamp and pool environments to smoothly scoured, hard-packed clay in reaches experiencing rapid flow. The pattern of alternating pool and riffle habitats common to many stream systems is, in general, poorly developed in this region because of the low gradients and unconsolidated bed materials characteristic of these streams.

Habitat diversity in the aquatic environments of the permit area and vicinity appears to be relatively low because of the nearly universal presence of fine-grained substrates, poor pool riffle development, and a general lack of aquatic vegetation to provide cover and/or food for a wider variety of aquatic species. The richest aquatic habitats are at road crossings where clearing has allowed sufficient light for rooted aquatic vegetation to develop, and rubble from road and bridge construction provides some areas of hard substrate.

Aquatic Biota. Phytoplankton abundance and species composition were found to exhibit considerable variation both seasonally and between stations. Abundances were generally low, with 84 percent of all samples containing total densities of less than 100 cells/ml. Phytoplankton communities were generally dominated either by flagellates (Euglenophyta and Cryptophyta) or by diatoms. The most consistently dense and diverse phytoplankton communities were observed in large pool habitats where low flow and reduced shading allowed populations to build up. Dominant phytoplankton species were often those recognized as tolerant of high levels of organic matter.

These observations are consistent with the hypothesis that the aquatic systems of the project area are primarily characterized by detrital-based food chains and that the contribution by "in situ" production is probably small. The observed small populations of zooplankton and the general lack of filter feeders among the invertebrates further supports this hypothesis.

Although zooplankton densities were generally low, species diversities tended to be relatively high, with the communities typically containing species of copepods, cladocera, and rotifers as dominants. Low zooplankton densities are common in small woodland streams because of the flushing effects of flow and low phytoplankton food availability. The zooplankton species collected were predominantly those characteristic of littoral or benthic habitats. Highest diversities (and densities) were observed in the large pool habitats that were generally dominated by species typical of weedy pond/pool habitats.

The macroinvertebrate fauna was dominated by oligochaetes and dipteran larvae, organisms typical of fine-grained substrates. Other major taxa present in appreciable numbers included the Crustacea (crayfish) and the insect orders Coleoptera, Odonata, Hemiptera, and Ephemeroptera represented by species at least moderately tolerant of turbidity and low DO concentrations. Macroinvertebrate abundance and diversity were strikingly related to habitat diversity, with those stations containing rooted vegetation and some substrate heterogeneity (i.e., rubble from bridge construction) tending to exhibit the most dense and diverse fauna. In other areas, terrestrial plant debris (leaf pack, logs) was important in providing macroinvertebrate habitat.

Major groups of fish observed in the permit area and vicinity were minnows, sunfish, darters, and pirate perch. Fish were not very abundant in the area, and individuals tended to be quite small. Most of the species collected are widespread throughout Louisiana or are extremely common in small aquatic habitats of this region.

Important Species. "Important species" are those which (a) are commercially or recreationally valuable; (b) are rare and endangered; (c) are critical to the survival of a species satisfying criteria (a) or (b); or (d) are critical to the structure or function of the ecosystem or are biological indicators. Aquatic species in the Dolet Hills Lignite Mine Project area that fall under these criteria are discussed below.

Commercially or Recreationally Valuable Species. Several sportfishes could be expected to occur in the permit area and vicinity. These include several catfishes, sunfishes, largemouth and spotted bass, and black and white crappie. Of these, seven species of sunfish (*Centrarchus macropterus*, *Lepomis macrochirus*, *L. punctatus*, *L. cyanellus*, *L. gulosus*, *L. megalotis*, and *L. microlophus*), black crappie, and two catfishes (*Ictalurus furcatus* and *I. puntatus*) were collected on-site. Breeding habitat for sunfish, crappie, and bass occurs mostly in smaller permanent streams where weedy areas are available. Most of these streams are located to the east of the project boundary in the lowland areas bordering Bayou Pierre. However, the low numbers caught and the low dissolved oxygen levels suggest that centrarchid game fishes are not abundant in the area. The catfish are more likely to breed in larger streams (e.g., Bayou Pierre) under cut banks.

Species of commercial value, marketable as food and collected on-site, include gars and catfishes. Baitfishes of some commercial importance are shad, shiners, and chubsuckers.

No commercial fishery is known to exist in the permit area for either crayfish or freshwater mussels. However, marketable crayfish were collected in small numbers in various aquatic habitats on-site, and some of the mussels collected on-site (Unionidae) have been exploited commercially elsewhere.

Rare and Endangered Species. The FWS's (45 FR 99:33768-781) list of threatened and endangered fish species contains no species known to occur in the project area. Miller (1972) lists the stoneroller (*Campostoma anomalum*), blackspot shiner (*Notropis atrocaudalis*), steelcolor shiner (*N. whipplei*), suckermouth minnow (*Phenacobius mirabilis*), bluntnose minnow (*Pimephales notatus*), and brown bullhead (*Ictalurus nebulosus*), as "rare" in Louisiana, although most are widely distributed in the eastern and central states. Since the blackspot shiner is commmon in the tributary waters of the upper Sabine River (Douglas, 1979), it could reasonably be expected to occur on or near the permit site. The other species listed have not been reported from western Louisiana, except for the suckermouth minnow which has been taken in the main stem Sabine River.

No freshwater mussels, snails, or crustaceans found on-site or of potential occurrence in the permit area are listed as threatened or endangered by the U.S. Department of the Interior (U.S. Department of the Interior, 1980).

Other Important Species. Although no single species could be considered critical to the well-being of the recreationally or commercially valuable species discussed above, forage fish, as a group, are extremely important as food items for the larger predatory game fish. Based on survey results, the most important forage species on-site appear to be minnows, shad, and mosquitofish. Smaller species (most sunfish) feed largely on aquatic invertebrates.

5.5.3.2 Effects of No Action

Under the no action alternative, adverse impacts of construction and operation of the Dolet Hills Lignite Mine Project would not occur. The currently dominant land uses, silviculture, and oil and gas production are expected to continue. Therefore, the present level and nature of impacts to the aquatic environments of the project area can be expected to continue.

5.5.3.3 Construction Impacts

Site preparation and construction activities include clearing of vegetation, construction of access and haul roads, and erection of administrative, maintenance and service buildings. Some of these activities (e.g., vegetation clearing, road construction), and others which may be classified as construction such as diversions and sedimentation ponds, will continue throughout the life of the project as mining progresses. Therefore, it should be recognized that the construction impacts, like the operation impacts, will not affect the entire project area simultaneously.

The activities listed above can be expected to impact the streams of the project site through: 1) destruction of existing stream channels (e.g., channel realignments); 2) increases in suspended solids loading; 3) changes in nutrient inputs; 4) reduction in the shade and organic material provided by riparian vegetation; and 5) alteration of the flow regime. Outside the permit boundaries, only 2), 3), and 5), above, could be expected to produce impacts on the downstream segments of these water courses.

Increases in suspended solids can be expected in the runoff from areas in which vegetation clearing, road building, or other construction activities take place. As the mining plan calls for the construction of 116 sedimentation ponds over the life of the project, impacts from this source will be considerably limited. The severity of impacts due to increased suspended solids loads is dependent on the concentration of suspended material, the amount of sedimentation which takes place, and the nature of the substrate and biota receiving the sediment. Fish may leave areas of high suspended solids concentration, but will return when conditions are favorable. Given the sediment control measures to be used, and the present, relatively high turbidity of area waters, direct impacts to fish populations from increased suspended solids loads are not expected to be significant, but there may be some periodic short-term adverse impacts on stream fisheries.

Of greater potential significance is substrate blanketing by sediment and destruction of aquatic vegetation and invertebrates. However, use of sediment control structures will prevent massive blanketing of stream beds, and the fine-grained nature (sand, silt and clay) of the substrates in the project area ensures that no long-term alteration of substrate type will result if sedimentation rates are temporarily increased during construction activities. In addition, area streams are presently dominated by a benthic invertebrate fauna characteristic of fine-grained substrates. Therefore, any adverse impacts resulting from increased suspended solids loads are expected to be short-term and localized.

5.5.3.4 Operation Impacts

Temporary stream diversions will be constructed within the permit area as follows: Chatman Bayou, 2,591 meters (8,500 feet) and 2,134 meters (7,000 feet); West Branch Dolet Bayou, 2,286 meters (7,500 feet) and 610 meters (2,000 feet); Prairie Bayou, 3,658 meters (12,000 feet) and 1,676 meters (5,500 feet); and Louies Bayou, 1,829 meters (6,000 feet) and 1,219 (4,000 feet). Permanent diversions will be as follows: Chatman Bayou, 3,353 meters (11,000 feet); Tenmile Bayou, 2,438 meters (8,000 feet); Louies Bayou, 2,667 (8,750 feet); and Prairie Bayou, 2,286 meters (7,500 feet). This will result in the loss of the habitats and biota of the existing channels. Although the new channels can be expected to be rapidly colonized, they are unlikely to have the habitat diversity of the natural channels. Because they will be straightened and because their watersheds will have a reduced vegetative cover, extremes in water level (discharge) are expected to be greater than in the natural channels. While these factors are expected to result in reduced habitat and species diversity, the lack of shading by riparian vegetation should result in an increase in aquatic vegetation over what presently exists. This could offset the adverse impacts of channelization on certain aquatic species since the baseline studies showed that existing areas containing stands of aquatic vegetation support the greatest abundance and diversity of aquatic life in the streams of the project area. The adverse component of these changes on aquatic species results primarily from the straightness of the channels and the consequent reduction of habitat diversity, while the magnitude of the beneficial component will depend on the capacity of the channel to retain sufficient water to support substantial stands of aquatic vegetation.

When forestland is cleared, concentrations of inorganic nutrients in runoff can temporarily increase by substantial amounts. Although the phenomenon is temporary, increases in aquatic macrophyte and algal growth can occur in reaches receiving sufficient sunlight.

Extensive removal of riparian vegetation from the streams of the project site, and construction of new, unshaded diversion channels will result in a change in the trophic structure of those stream reaches. These streams are presently dominated by detrital food chains dependent on litterfall from the surrounding woodlands. _In situ_ production by algae and macrophytes is, at present, largely confined to areas such as road crossings, that have been cleared. While extensive alterations in the abundance and composition of the algal and macrophyte flora can be expected, the effects on other components of the aquatic community are less clear, but are discussed below.

Zooplankton and littoral microinvertebrate densities will probably rise due to increases in phytoplankton food availability and the additional cover provided by more extensive stands of aquatic vegetation. The factors affecting potential changes in the macroinvertebrate community are more complex. Although _in situ_ production will to a large degree supplement terrestrial organic material at the base of the food chain, it must be pointed out that the largest proportion of aquatic macrophyte production also enters the food web as detrital material, rather than being cropped when living. Deposit feeding organisms (e.g., most oligochaetes) may be largely unaffected, as the source of organic material in the sediments appears to be unimportant relative to the amount available. Some changes may occur in the composition of the detritus feeding fauna as the source of detritus changes from (mainly) terrestrial plant leaves to aquatic vegetation, but too little is known about the dependence (or lack thereof) of these species to specific detrital sources. Two groups of macroinvertebrates, the scrapers/algal grazers and the filter feeders can be expected to increase in abundance and diversity in response to these changes. Additionally, the increased habitat diversity provided by macrophyte stands can be expected to result in some increase in macroinvertebrate abundance and diversity. Fish species feeding on macroinvertebrates (e.g., sunfishes, catfish) would be affected by changes in invertebrate species composition and distribution only insofaras the availability, or catchability, of prey items changed. For instance, the greater abundance and variety of invertebrates generally associated with aquatic vegetation may result in some increases in sunfish and topminnow populations.

Other factors attendant to the change from woodland to open stream habitat that may affect the fish community include increases in the ranges of variation in temperature and water level, and increased availability of cover in stands of vegetation. Increased summer temperatures could have adverse impacts on fish populations, while increased oxygen levels and cover provided by aquatic vegetation could have beneficial impacts.

The changes in stream communities in response to removal of forest cover outlined above will be extensive and long-term. These streams are presently mosaics of wooded and open reaches, and the proposed project will substantially alter the proportions of those two major habitat types. Except perhaps in channelized reaches experiencing extended low flow periods, species diversity and overall abundance is not expected to decline in any of the major groups, and some increases may occur. Long-term adverse impacts can be expected in those channelized reaches experiencing extreme variation in water level (discharge), in which little physical habitat diversity is available, and which do not develop extensive stands of aquatic vegetation.

Impacts from mine operations beyond those outlined above appear to be limited to effluent discharges (sanitary, area runoff, and mine dewatering) and changes in hydrologic regime.

Interception and treatment of sanitary wastes, runoff from maintenance and storage areas, and mine dewatering effluents will be conducted in accordance with the provisions of an NPDES permit. Sedimentation control structures and, where appropriate, planting of vegetation cover on exposed soil surfaces will be used to control the level of suspended solids in runoff water. Operation of the sediment control structures together with the lack of sensitivity of the aquatic biota and habitats in the area to limited elevations in suspended solids will result, at worst, in short term, reversible impacts.

Potential impacts to aquatic communities also include drainage of acidic, metal-bearing waters from exposed overburden piles made up of materials having a high acid forming potential. However, since LOCSMD regulations require burial of this material within

30 days, no impacts from this source are expected. A period of this substantially longer than 30 days would be required before oxidation of pyritic materials in the exposed overburden would result in substantial acid formation (see Section 5.1.3.4).

The degree to which mining activities will alter the present stream flow regime cannot be accurately predicted. Ordinarily, clearing of forest cover would result in more rapid runoff, increased flood peaks, and extended low flow periods. However, the large number of sedimentation ponds to be used should substantially retard the runoff peaks and release the impounded water more slowly, somewhat approximating the hydrologic effects of the original forest cover.

5.5.3.5 Combined Impacts of Power Plant and Mine

Combined beneficial and adverse impacts of the power plant, its associated facilities, and the mine will include: 1) a net increase of makeup water pond and permanent sedimentation pond habitat and associated aquatic communities; 2) a preemption of perennial and intermittent stream habitat in the plant and mine site; 3) increases in aquatic species, increases in primary and secondary production, and creation of new feeding or refuge areas at transportive system stream crossings and haul road crossings where existing vegetation is removed; and 4) minimal entrapment and impingement of aquatic biota at both the water intake from Toledo Bend Reservoir to the makeup water pond and from the makeup water pond to the plant. Further, temporary sedimentation and erosion in the vicinity of power plant and mine construction activities and streams crossed by transportive system corridors could result in reduced phytoplankton and possibly zooplankton, benthos and fish populations; possible reduction in benthic habitat diversity; and increased nutrient levels.

5.6 CULTURAL RESOURCES (PREHISTORIC AND HISTORIC)

5.6.1 Prehistoric Overview

The Dolet Hills Lignite Mine Project area is located in the northwestern section of Louisiana in southeastern De Soto Parish. Previous archaeological work in the immediate vicinity of the permit area revealed a long cultural-historical development. Clovis, Scottsbluff, Meserve, Quad, and Angostura projectile points indicating a Paleo-Indian occupation are common in this area (Heartfield, Price and Greene, Inc., 1980). A number of Scottsbluff points contained in a private collection were found south of the project area in Sabine Parish. The John Pearce Site, situated in Caddo Parish just north of the project area, revealed in situ Paleo-material, including a San Patricio projectile point that indicates a late sequence spanning into the Archaic. The Archaic is one of the least-known periods of prehistory in this area. The Neo-American period is recognized by the introduction of pottery and arrow points and the appearance of semi-permanent or permanent village and hamlet sites. Tchefuncte, Marksville, Bellevue, Troyville, Coles Creek, and Caddo I through V are cultures recognized as having occupied areas in the vicinity of the project area.

5.6.2 Historic Overview

At the time of European contact, agricultural Caddoan-speaking people inhabited the general area of northwestern Louisiana and lived in dispersed hamlets. They maintained an extensive trade network that extended from the Lower Mississippi Valley into Texas and Oklahoma (Gregory, 1973). In the 18th century, France and Spain attempted to establish missions in the area surrounding the Red and Sabine rivers. In the 19th century, they were followed by early American immigrants, who had an economy based on stock raising. In 1835, the Caddo Indians ceded their lands within the United States, thereby making it available to immigrants. By 1836, the area was intensively cultivated with cotton, sugar cane, and rice.

During the Civil War the Red River became the target of federal interests. By March of 1864 General Banks' army controlled Natchitoches and had begun to move toward Shreveport. Meanwhile, General Richard Taylor was concentrating his confederate forces around Mansfield. The battle took place three miles southeast of Mansfield on Moss Plantation. Although the Confederate victory was not decisive it resulted in a retreat of federal troops and an end to the Red River Campaign.

5.6.3 Cultural Resources within the Permit Area

The proposed permit area comprises 11,968 hectares (29,573 acres). A review of the records indicates that 2,163 hectares (5,345 acres) or 18 percent of the permit area have been previously surveyed as part of two separate projects. The first project was the North-South Expressway Realignment Survey (Heartfield and Clendenen, 1975; Heartfield et al., 1978), and the second was the Dolet Hills Lignite Prospect Survey (Heartfield, Price and Greene, Inc., 1980).

A total of 59 cultural resources sites within the mine permit boundaries were recorded during these surveys. These included 13 archaeological sites, 10 standing structures, 27 possible archaeological sites, 7 isolated occurrences, and 2 historic cemeteries. The Mansfield Battle Park (16DS187), located west of the permit area, is currently listed on the National Register of Historic Places (NRHP).

No known cultural resources sites within the surveyed portion of the permit area are listed on the NRHP. One historic standing structure (16DS153) is considered eligible for nomination to the NRHP by Heartfield, Price, and Greene (1980) and has been recommended for further work. Three additional historic standing structures (16DS144, 16DS145, and 16DS164) and one historic cemetery (16DS154) are recommended for further evaluation to determine their potential for nomination to the NRHP (Heartfield, Price, and Greene, 1980).

Site 16DS153 is composed of a large pre-Civil War modified dogtrot residence, a wood and sheet metal storage shed and a wooden pumphouse. The main house has been reported to have been used as a temporary hospital during the Battle of Mansfield or Sabine Crossroads. The construction date, its excellent condition, and the fact that the structure was used during the Civil War, make it potentially eligible for nomination to the NRHP.

Site 16DS144 is a late 19th or early 20th century farm complex consisting of a 1½-story bungalow style house, a multi-crib barn, and a wooden pumphouse. The property is in excellent condition and represents a vanishing folk-type house.

Site 16DS145 is an early farm complex composed of a main residence, a garage, two single-crib barns, chicken sheds, a single-crib house, and a double-crib barn.

Site 16DS164 is an early 20th century farm complex containing a house, a barn, and three wood and sheet metal sheds. The main house was built in 1913 and is in good condition.

Site 16DS154 is the present location of the Grove Hill Church and Cemetery. The cemetery, situated 50 meters (164 feet) southeast of the church, dates to 1855. One section of the cemetery contains markers of Louisiana soldiers who lost their lives during the Civil War Battle of Mansfield or Sabine Crossroads. The church has been moved and appears to have been modified or restored.

5.6.4 Effects of No Action

The no action alternative would eliminate the potential adverse impacts of construction and operation related to the proposed Dolet Hills Lignite Mine Project. If the proposed mine is not constructed, environmental conditions within the permit area would remain approximately as they presently exist, with the exception of deterioration due to natural weathering and possible vandalism of cultural resources sites. Existing cultural resources sites would not be impacted by the project, and there would be no need for determinations of NRHP eligibility or any further work. The no action alternative would result in elimination of government intervention on significant sites which may exist within the project boundaries. Knowledge gained through investigation of these sites as part of regulatory requirements would be lost.

5.6.5 Construction Impacts

Surveys conducted on 18 percent of the proposed permit site have identified 59 cultural resources sites. Two of the sites, 16DS145 and 16DS154, are within the ancillary activities area. Construction of the main office, field offices, erection pads, haul roads, conveyor system, etc. will not affect either site but a potential exists for indirect impacts (e.g., increased exposure to human contact). Surveys of the remaining 82 percent of the permit area could reveal the location of additional cultural resources sites within the impact area that may be eligible for nomination to the NRHP.

A Draft Memorandum of Agreement (MOA) has been prepared by EPA for review by the Louisiana State Historical Preservation Officer (SHPO) and the Advisory Council on Historic Preservation to comply with Section 106 of the National Historic Preservation Act (NHPA) (see Appendix D). The intent of this MOA will be to avoid or minimize construction-related adverse impacts on cultural resources. Prior to construction activities, potential project-related adverse effects on significant cultural resources will be coordinated with the SHPO of Louisiana.

5.6.6 Operations Impacts

Mine site operations will impact three cultural resources sites that have been recommended for further work. The first, site 16DS153 is considered eligible for nomination to the NRHP (Heartfield, Price, and Greene, 1980). It contains a pre-Civil War structure that was used as a hospital during the Civil War. According to the mining schedule, this site will be impacted in the year 2007. The second site, 16DS144, is recommended for further testing to determine its possible nomination to the NRHP. The site is a late 19th or early 20th century farm complex in excellent condition that may contain a vanishing folk-type house. The site will be impacted in the year 2005. The third and final site, 16DS164, is recommmended for further testing to determine its nomination potential to the NRHP. This site is an early 20th century farm complex that may be architecturally significant, and it will be impacted in 1998. Mining operations will not come within 30.4 meters (100 feet) of Site 16DS154, Grove Hill Cemetery, which is in the ancillary activities area.

Mining operations are scheduled to be performed near Mansfield Battle Park around the year 2003. Mining will not be initiated within 91 meters (300 feet) of the park in compliance with LSMR 161.11(f). Cultural resources that may be associated with the battle area around the park and that may be affected by mining operations should be addressed by the MOA.

The probability exists that additional cultural resources sites eligible for inclusion on the NRHP may be located on the remaining unsurveyed portion of the proposed permit area. Impacts on sites recommended for further testing will be coordinated through the Louisiana SHPO, as specified by the MOA.

5.6.7 Combined Impacts of Power Plant and Mine

Cultural resources sites encountered during field surveys of the proposed mine/power plant project are given in detail in Section 5.6.3 of this document and Section 4.6 of the Draft EIS for the Dolet Hills Power Plant Project (EPA, 1981). They are summarized as follows: 1) Power plant project - No cultural resources sites on or eligible for nomination to the NRHP were found within the proposed area of the power plant facilities during a 100-percent survey. A railroad right-of-way was surveyed prior to construction clearing activities in accordance with an MOA between the EPA, the Louisiana SHPO, and the

Advisory Council on Historic Preservation. No significant cultural resource sites were encountered (EH&A, 1982b). During construction clearing activities Site 16DS212 was discovered. The site contained both early Caddo and Historic Caddo components. A testing program was conducted followed by mitigation of the site. These investigations were coordinated with the Louisiana SHPO. The draft report containing results of these investigations will be submitted to the Louisiana SHPO for review; 2) Mine site - Three cultural resources sites within the 18 percent portion of the mine area already surveyed have been recommended for further work. Two additional sites occur within the ancillary activity area.

5.7 SOCIOECONOMICS

5.7.1 Existing Environment

The existing socioeconomic conditions in the four-parish area (De Soto, Sabine, Red River and Natchitoches), as presented in the Dolet Hills Power Plant Draft EIS (EPA, 1981), have remained relatively unchanged up to now. The following sections, therefore, present summaries of that document or new information that has become available since the publication of the 1981 EIS. More detailed information and methodologies may be found in EH&A, 1981c.

5.7.1.1 Economic Profile

Manufacturing, trades, and services continue to be the leading economic sectors in the area with regard to employment and income. Local unemployment rates have risen nearly two percentage points since 1980. Reported 1981 unemployment rates ranged from 7.7 percent in De Soto Parish to 10.6 percent in Sabine Parish, compared to 8.4 percent for the State (Robinson, 1982).

Personal income increased at a slight-to-moderate rate in most sectors since 1980. Manufacturing, which increased most notably in Natchitoches Parish, is the leading income producer in all four project-area parishes. In addition, per capita income in the area improved slightly, reaching 74 percent of the State average. Natchitoches Parish reported the largest per capita income increase (U.S. Department of Commerce, Bureau of Economic Analysis, 1981).

5.7.1.2. Population Profile

The 1980 Census data presented by EPA (1981) (Section 4.7.1.2) represent the most recent information available for the project area. According to 1980 Census estimates, population growth averaged 18 percent in the four-parish project area during the 1970's. Natchitoches, Mansfield, and Many were the only project area communities with populations over 2,500 (the Census definition of an urban area). Nonwhites accounted for approximately 40 percent of the project area population, a slight decrease from the 44 percent share in 1970.

5.7.1.3 Housing

Communication with the Coordinating and Development Corporation (CDC) of northwestern Louisiana regarding an update of the preliminary regional housing study (discussed in EPA, 1981), indicates that there are no new major residential construction projects in the area. Mobile homes continue to be the most abundant source of housing. The turnover of construction workers on projects throughout the four-parish area has resulted in a mobile home vacancy rate of 13.8 percent (Stothart, 1982).

5.7.1.4 Community Services and Facilities

In addition to housing, water supply and wastewater systems represent the most critical facilities when considering capabilities to accommodate an increasing population. Recent information indicates that the treatment facilities in most of the major project area communities continue to have unused capacity, although structural improvements are needed. (Data on community facilities are derived principally from the Coordinating and Development Corporation of Northwestern Louisiana (CDC, 1982)).

With respect to fresh water supply systems, the treatment plants in both Mansfield and Natchitoches have considerable excess capacity at current consumption rates. However, both cities have water storage deficiencies, according to State planning standards. The town of Coushatta continues to rely on an old fresh water treatment and distribution system which cannot adequately meet existing demands, particularly during peak periods. The City of Many's fresh water system currently has excess capacity in its treatment plant, but some of the system water lines are undersized and deteriorated; treated water quality is generally considered to be unacceptable. Both Coushatta and Many also have insufficient water storage capacities, under State standards.

The wastewater treatment plants in both Mansfield and Natchitoches have excess capacity to accommodate increased loading. The systems in both cities are deficient in other respects, however. In Mansfield, the sewer mains are too small to handle a significant population increase, and the sewage lagoon has insufficient acreage according to State standards; nevertheless, the existing wastewater facilities are considered adequate to handle an additional 9,000 users to the system without new facilities (CDC, 1982). The Natchitoches wastewater system also utilizes undersized, deteriorated lines in some areas, and some lift stations are overloaded at peak periods. Similarly, the towns of Coushatta and Many operate older wastewater facilities which will need renovation and expansion to accommodate growth (CDC, 1982).

With regard to police and fire protection in the project area, manpower levels are adequate. However, structural facilities need improvements and/or expansion. In some areas, additional vehicles and equipment are needed to provide adequate service to the existing population (CDC, 1982).

Health and educational data presented by EPA (1981) represent the most recent information available.

5.7.1.5 Local Government Finances

Combined 1981 mill rates (tax per hundred dollars of assessed property valuation) for major towns in the project area ranged from \$36.23 to \$102.00. A one-percent sales tax is levied by parish school boards and the cities of Coushatta and Natchitoches. The total mill rate for Ward 4 of De Soto Parish (location of the proposed mine) equaled \$31.47 in 1981.

Local governmental finances are characterized by a lack of surplus funds, dependence on intergovernmental revenues, and low levels of bonded indebtedness. Industrial development in the region will increase revenues through industrial, residential, and commercial tax base growth as well as severence tax receipts.

5.7.1.6 Transportation Facilities

The major highways serving the immediate project site area are U.S. 84, U.S. 171 and State Highway (LA) 1. U.S. 84 travels in an east-west direction, connecting Mansfield to Coushatta, while U.S. 171 and LA 1 travel in a north-south direction, connecting Shreveport to the project area. Average daily traffic (ADT) along U.S. 84 near the project site entrance increased 62.5 percent between 1980 and 1981, from 1,140 to 1,853 vehicles per day. Reported ADT levels in 1981 range between 4,357 and 4,880 vehicles along LA 1 and between 3,300 and 6,881 vehicles along U.S. 171 (Louisiana Department of Transportation and Development, 1981).

Transportation operations along these major thoroughfares in the project area are becoming strained by increasing transportation demands. Reconstruction of U.S. 84 has begun near the proposed project site entrance. In addition, plans have been formulated to construct Interstate (I) 49, a north-south four-lane expressway connecting I-10 (Lafayette) with I-20 (Shreveport). Construction on the section traversing De Soto Parish will occur sometime between 1984 and 1986.

5.7.1.7 Recreation Facilities and Aesthetics

The majority of the recreation sites in the project area vicinity are local and parish-supported parks. However, Mansfield Battle State Park, the Sabine State Wildlife Management Area, and portions of the Kisachie National Forest are located in the four-parish project area. According to planning standards used by the Coordinating and Development Corporation, the project area is in serious need of more basketball courts, playgrounds and playfields (CDC, 1981).

5.7.2 No Action Alternative

The no-action alternative would eliminate the beneficial and adverse impacts of construction and operations of the proposed lignite project. If the proposed mining project is not undertaken, the projected adverse impacts to area communities associated with in-migrating population (i.e., housing, transportation, services) would not occur, and the project benefits, in the form of jobs, income, and local tax revenues, would be lost. Because the proposed Dolet Hills Lignite Mine Project is one of several lignite or other industrial projects proposed or now underway in the area, it is unlikely that these project-related effects of no action would substantially alter future community conditions or area development patterns.

5.7.3 Construction Impacts of the Proposed Project

5.7.3.1 Economic Impacts

Direct Employment. Major construction of the proposed Dolet Hills Lignite Mine Project is scheduled to begin in the third quarter of 1983 with 45 workers, increasing to a peak of 112 workers in the first half of 1984 and constitutes a direct short-term beneficial impact. Construction employment will begin to decline thereafter and will cease by the beginning of 1987. See Table 5-14 for a detailed schedule of construction employment.

Due to the shortage of skilled construction workers and the competing labor demands of several other major construction projects in the project area, it is estimated that only about 22 of the peak 112 construction workers will be hired from the local labor force. Approximately 45 of the remaining 90 workers will in-migrate into the area, and an equal number will commute from outside the area. Most of the commuting workers will come from Shreveport, which is about 45 minutes away by car and offers adequate housing, services, and amenities.

The number of construction workers who in-migrate is difficult to predict precisely because of the variable construction schedules of the other major construction projects in the area. It is therefore possible that the extent of in-migration for the proposed project may be somewhat mitigated by the release of construction workers from another project. (For further information on this point, see "Cumulative Effects," Section 5.9.)

Indirect Employment. Indirect, or secondary, employment is a beneficial impact created as a result of increased service demand and income associated with contruction employees. The total potential of a basic construction work force to support secondary employment within the local project area is diminished by the tendency of workers, including those who reside locally, to spend a significant portion of their income outside the project area. Based on observations of similar energy projects, it is estimated that each locally residing construction worker will support the employment of 0.8 secondary workers. As shown in Table 5-14, at peak construction the 67 locally residing workers would thus support a total of about 54 secondary jobs. While local workers would

TABLE 5-14

LOCAL EMPLOYMENT EFFECTS RESULTING FROM PROJECT CONSTRUCTION

1982-1986

Year/Half	Project Construction Employment				Induced Service Employment			Direct and Indirect Employment		
	Residents	In-Migrants	Commuters	Total	Residents	In-Migrants	Total[a]	Residents	In-Migrants	Total
1982.1	2	4	4	10	1	4	5	3	8	11
1982.2	1	3	2	6	1	2	3	2	5	7
1983.1	1	3	2	6	1	2	3	2	5	7
1983.2	9	18	18	45	4	18	22	13	36	49
1984.1	9	18	18	45	4	18	22	13	36	49
1984.2	22	45	45	112	11	43	54	33	88	121
1985.1	22	45	45	112	11	43	54	33	88	121
1985.2	13	26	26	65	6	25	31	19	51	70
1986.1	6	12	12	30	3	11	14	9	23	32
1986.2	6	12	12	30	3	11	14	9	23	32

Source: CLECO, 1982.

a. Total Induced Employment = 0.8 x total non-commuting construction employment.

ordinarily be expected to fill a substantial percentage of these jobs, the secondary job opportunities already created by other projects in the area could absorb much of the existing local labor force. Therefore, it is estimated that of the 54 secondary jobs associated with the proposed project, 43, or 80 percent, will be filled by in-migrant workers and 11 will be filled from the local labor force.

Income Effects. Beneficial direct income effects of the proposed mine project include salaries paid to construction workers and expenditures for machinery and equipment, materials, power and fuels, insurance and interest, and the relocation of structures. Secondary income effects flow from local consumer expenditures by construction workers and from expanded income generated by local aquisition of materials and equipment. Estimated project construction expenditures are shown in Table 5-15.

Labor expenditures over the 3.5-year construction period are projected at $4.9 million, exclusive of benefits, with $2.45 million occurring in the peak construction years (1984-1985). Local secondary income is calculated on the basis of (1) a regional secondary multiplier of 2.126 (U.S. Department of Commerce, Bureau of Economic Analysis, 1979), (2) the projection that 60 percent of the total construction force will reside locally, and (3) an assumed local expenditure capture rate of 60 percent. According to these assumptions, the $4.9 million total construction labor expenditure will yield about $3.75 million in secondary income captured in the project area.

Beneficial secondary income effects would also result from project expenditures on equipment, materials, and other nonlabor requirements, projected at an estimated $63.2 million. Of the $51.1 million to be spent on machinery, materials, power, and fuels, it is estimated that about 7 percent, or $3.46 million, will be spent locally. It is assumed that none of the insurance and interest expenditures and all of the relocation expenditures will be local. Total direct nonlabor income effects on the project area thus amounts to approximately $4.1 million. Assuming the regional income multiplier of 2.126, local secondary income from nonlabor expenditures could amount to about $8.7 million.

5.7.3.2 Population Effects

During the construction period, a number of primary and secondary workers, many with families, will move into the project area. The assessment of the overall effects of this in-migration upon the project area population is based on several assumptions about the

TABLE 5-15

ESTIMATED PROJECT CONSTRUCTION EXPENDITURES
(thousands of 1981 dollars)

Cost Item	Total Construction Period		Peak Construction Year	
Labor				
Direct Wage and Salary	$ 4,900		$ 2,450	
Fringe and Benefits	980		490	
Subtotal		$ 5,880		$ 2,940
Capital Expenditures				
Machinery/Equipment	47,844		19,108	
Materials	2,500		1,800	
Power and Fuels	800		300	
Subtotal		51,144		21,208
Other				
Insurance, Interest	11,360		7,350	
Relocation of Structures and Unallocated General Expense	650		200	
Subtotal		12,010		7,550
TOTAL		$69,034		$31,698

family characteristics of energy project direct and secondary workers. In studies of similar energy projects, it was observed that approximately 60 percent of construction workers are married, with an average family size of 3.55 persons (Denver Research Institute, 1979). Among secondary workers, it was found that 90 percent are married, with an average family size of 3.59. It was also observed that, among married secondary workers, half are likely to be married to each other.

Applying these assumptions to the direct and secondary workers expected to move into the area (see Table 5-14), it is projected that during the peak years 1984-85, the project area population will be increased by 114 persons due to direct employment and by 124 persons due to indirect employment, for a total construction-phase population increase of about 238 persons. According to a survey of in-migrants conducted for a western energy project, typical newcomers to the area will have a median age of 22 years (Mountain West Research, Inc., 1975). In 1970, the median age in the four-parish project area ranged from a low of 23.9 years in Natchitoches Parish to 28.8 years in Sabine Parish (U.S. Department of Commerce, Bureau of Census, 1971).

Due to the short duration of the construction period, many in-migrant workers and families will be temporary residents only. However, coupled with other major planned construction projects, the rapid influx of these people into the area will create adverse short-term demands on local facilities and services. Most of the 124 persons associated with secondary employment are expected to remain in the area to support the service needs of permanent operations workers and their families, thereby somewhat lessening population impacts over the long term.

The importance of construction-related in-migration to any single project-area community depends on the probable distribution of new residents at peak employment among area communities within a 30-mile radius. To calculate this distribution a methodology was employed which accounts for (1) distance from the mine site, (2) services and amenities (as indicated by current population), and (3) capacity to expand (as indicated by recent growth rate). Employing these factors, the distribution calculations indicate that, of the total project-related population increment, 46 percent would live in Mansfield, 32 percent in Natchitoches, 12 percent in Coushatta, and 10 percent in Many. The estimated distribution of construction-related population and its related demands on housing and water and wastewater systems are shown in Table 5-16. It should be noted that these effects are limited to the project's construction phase only. Long-term facility

TABLE 5-16

DISTRIBUTION OF PEAK CONSTRUCTION-PHASE POPULATION AND RELATED COMMUNITY EFFECTS[a]

Municipality	Estimated Distribution Rate (%)	Estimated Peak Construction-Related In-Migrant Population	Estimated Housing Demand (units)	Estimated Water Demand (MGD)[b]	Estimated Wastewater Demand (MGD)[b]
Mansfield	46.0	109	56	.017	.011
Many	10.0	24	12	.004	.002
Natchitoches	32.0	76	39	.012	.008
Coushatta	12.0	29	14	.004	.003
TOTALS	100.0	238	121	.037	.024

a. Peak construction employment occurs in 1984-85.

b. For conversion to metric units, see Conversion Table.

planning must be based upon the combined effects of construction and operations phases; these effects are addressed in Sections 5.7.5.2 through 5.7.5.4, below.

5.7.3.3 Housing

During peak contruction in 1984-85, in-migrating primary workers and families will require 56 housing units, while in-migrating secondary workers and families will require 65 units, based on an assumption of 1.2 and 1.5 workers per household, respectively (Mountain West Research, 1975). Total project-related housing demand in the four-parish area is estimated at 121 units. The probable distribution of construction-phase housing demand among the principal area communities is shown in Table 5-16. Based on employee family characteristics of other energy projects, it is expected that about 46 percent of the construction workers will prefer single-family housing, 38 percent will prefer mobile homes, and 17 percent will seek multi-family homes.

The type of housing accommodations actually achieved by in-migrant workers will depend on the existing or near-term availability of housing units, the availability of financing and buildable sites, and the capabilities of local builders. At present, all four parishes and the four principal communities in the area have without-project housing deficiencies. Additional demands created by construction-related in-migrating population will create additional adverse demands on the area's presently tight housing market. The project area average vacancy rate for owner-occupied housing is extremely low. Rental units are somewhat more abundant, while mobile homes exhibit a high 13.8 percent vacancy rate (Coordinating and Development Corporation, 1981).

Recent housing developments indicate an acceleration of single-family and apartment construction. The cities of Natchitoches, Many, and Mansfield permitted 110 new single family units in 1979 and another 121 in 1980 (Wildersonn, 1981; Brown, 1981). Apartment complexes have recently been completed in Mansfield, Many, and Coushatta, while major subdivision projects are being developed in the Mansfield area. Expansion of housing is constrained by deficiencies in utility infrastructure in all area towns. Because of the problems associated with the area's present projected single- and multi-family housing, it is likely that mobile homes will be the predominant form of housing for in-migrating construction workers and their families.

5.7.3.4 Community Facilities and Services

The four-parish project area is predominantly rural and undeveloped with a high percentage of households currently not served by public water supply or wastewater services. While most of the project area's major municipal utility systems have sufficient treatment capacity, some systems suffer from infrastructural problems. As a result, these systems may require capital improvements if project-related housing, water supply, and wastewater needs are to be met by development within municipal boundaries.

Water and Wastewater Systems. At peak construction, the 114 construction-related in-migrants will require 66,880 liters (17,670 gallons) of water per day, and the 124 in-migrant persons associated with secondary employment will require 72,787 liters (19,220 gallons) per day, assuming 586 liters (155 gallons) per day per person. Total peak fresh water demand by construction phase in-migrants thus amounts to 139,629 liters (36,890 gallons) per day. The distribution of this demand among area communties is shown in Table 5-16.

The total excess capacity of the fresh water treatment plants in the cities of Natchitoches, Many, Coushatta, and Mansfield can accommodate approximately 32,800 additional persons. However, the fresh water treatment system of the City of Coushatta has an existing deficit capacity. In addition, all four project-area cities have water storage deficiencies according to State planning standards. Specific project-related impacts will depend upon the schedule of non-project related growth in the area. Based upon the Coordinating and Development Corporation's expected phasing of area growth, the addition of 238 in-migrants associated with project construction is not expected to generate demands in excess of community fresh water supply system capacities, particularly if project-related workers tend to concentrate in Mansfield and Natchitoches, where the greatest capacity exists (CDC, 1982).

Wastewater facilities in the project area are severely limited and may be adversely impacted by in-migrating workers unless steps are taken to accommodate the increased population. The communities of Many and Natchitoches have limited capacity for expanded wastewater service. In Mansfield, there are deficiencies in the city's wastewater collection system. However, the city's waste treatment facilities should be able to accommodate an additional 9,000 users to the system without new facilities (CDC, 1982). Total estimated demand for in-migrating construction workers and their familes, assuming 378 liters (100 gallons) consumption per day per person, is about 43,149 liters (11,400 gallons) per day during the peak construction phase. Secondary population requirements will total approximately 46,834 liters (12,400 gallons) per day in additional sewage treatment capacity. The distribution of total construction-phase wastewater demand of 90,083 liters (23,800 gallons) per day is shown in Table 5-16.

Services. At peak construction, the total of 238 construction-related in-migrants may cause some local community services to operate above their prescribed capacities. Recommended service ratios for police and fire protection, health facilities, and schools are as follows: one police officer per 500 persons, one jail cell per 1,000 persons (Louisiana Municipal Police Association, 1981); two fire protection personnel per 1,000 persons (National Fire Protection Association, 1967); one doctor per 1,000 persons, 5.8 hospital beds per 1,000 persons, one nursing home bed per 100 persons (North Louisiana Health Systems Agency, Inc., 1980); one classroom per 21 pupils, one teacher per 18.6 pupils (Mountain West Research, Inc., 1975; Foster, 1975).

On the basis of these prescribed ratios, the project-related in-migrant population will not necessitate service expansions in any community police or fire departments. Health service expansion requirements can be satisfied by the addition of one hospital bed and one nursing home bed in Mansfield. Based on family characteristics identified in similar energy projects, primary and secondary in-migrant families will include about 51 school age children. Given the probable distribution of these families throughout the project area, Mansfield area schools will probably require one additional schoolteacher and one classroom due to construction-related in-migration. If construction workers demonstrate a slightly higher than expected locational preference for Natchitoches, schools in that city may also require one additional classroom and teacher. The Many and Coushatta school systems will be able to absorb the construction-phase demand without additional classroom or teachers.

5.7.3.5 Transportation

Public transportation routes (such as LA 522) will be used to facilitate delivery of equipment components to the dragline erection sites and to provide good mine routes for the equipment after erection.

Construction of the proposed mine project will create minor increases in traffic along U.S. 84 and 171 and LA 1 and 175. At peak construction, 112 mine workers will generate approximately 187 vehicle trips per day, assuming two trips per day and an average of 1.2 employees per vehicle. Commuting workers traveling LA 1 or U.S. 171 from Shreveport account for 75 of these employment-related trips. In the unlikely event that at peak construction all mine workers were to converge upon the project site by the same arterial, increase over existing average daily traffic (ADT) levels would amount to, for example, about 16 percent for U.S. 84 and less than five percent for LA 1. Actual employment-related vehicle traffic will of course be more evenly distributed among area arterials, although concentrations will occur along LA 1 and U.S. 171.

The number of nonwork related vehicle trips likely to be generated by the proposed project can be roughly estimated by assuming approximately 10 vehicle trips per day per in-migrant household (Institute of Traffic Engineers, 1979). Thus the in-migrating construction population, consisting of 56 households, will generate about 560 trips per day, while the 65 households associated with in-migrant secondary workers will generate about 650 trips per day. Given the predicted distribution of construction phase in-migrants (see Section 5.7.3.2), the total of 1,210 nonwork-related vehicle trips per day may be expected to occur over arterial and feeder roads and city streets in and around the four municipalities approximately as follows:

City	Trips Per Day
Mansfield	484
Many	121
Natchitoches	387
Coushatta	145

Adding the 112 work-related trips by in-migrant construction workers yields a total of 1,322 vehicle trips per day generated by project-related in-migrants. Total project-related traffic is estimated to be 1,397 vehicle trips per day throughout the project area. In addition to daily traffic, the construction phase of the project will require approximately 20 one-way trips requiring overload permits (greater than 30 tons).

Project-related traffic effects could be significant when compared with existing ADT levels since most of the major arterials in the project vicinity are already heavily travelled. Several are approaching or have exceeded design capacity. Consequently, the effects of relatively small traffic increments on these roads may be magnified in terms of congestion and safety. Other major industrial projects within the area are also likely to increase the problem in the near future. The planned construction of I-49 a north-south four-lane expressway connecting I-10 (Lafayette) with I-20 (Shreveport), will do much to alleviate traffic congestion. The section of I-49 crossing De Soto Parish is scheduled for completion between 1984 and 1986 (Stockwell, 1981).

Project effects on the region's rail system will be minimal. Most heavy equipment will be shipped by rail to Mansfield and then driven to the site by road. The construction of roads and drainage ways on-site will probably require some crushed rock, which is likely to be brought in by rail.

5.7.3.6 Recreation Facilities and Aesthetics

The project area has been designated a "moderate need" area by the Louisiana State Parks and Recreation Commission. Construction of the mine facilities is unlikely to have any noticeable effect on area recreational facilities, although primary and secondary in-migrating population could place additional strain on the region's already deficient urban recreational facilities. No adverse impacts on the aesthetic nature of the area should result other than general construction activities.

5.7.4 Operations Impacts of the Proposed Project

5.7.4.1 Economic Impacts

Direct Employment. The operations phase of the proposed mine project will actually be developed in two stages. Phase I is scheduled to begin in October of 1985 with 164 employees and will expand to full operations by April of 1986, when 207 workers will be employed. Operations employment will remain relatively stable until 1993, when additional lignite production will create a need for an additional 187 operations workers. From this point, operations employment should remain the same throughout the remainder of the project. See Table 5-17 for a detailed operations employment schedule. During the operations phase, it is expected that about 90 percent of the total work force will be in-migrant, with only 10 percent hired locally.

TABLE 5-17

LOCAL EMPLOYMENT EFFECTS RESULTING FROM PROJECT OPERATIONS 1985 - 2017

Year/ Half	Project Operations Employment			Induced Service Employment			Cumulative Employment		
	Residents	In-Migrants	Total[a]	Residents	In-Migrants	Total[b]	Residents	In-Migrants	Total
1985.2	16	148	164	61	154	215	77	302	379
1986.1	21	186	207	73	224	297	94	410	504
1986.2	21	186	207	73	224	297	94	410	504
1987-1991	21	189	210	74	241	315	95	430	525
1992	21	192	213	75	245	320	96	437	533
1993-2017	40	360	400	131	469	600	171	829	1000

a. Source: CLECO, 1982.

b. Total Induced Employment = 1.5 x total operations employment as adjusted for presence in area of construction-induced secondary workers.

Indirect Employment. Based on observations of similar energy development projects, each operations employee would be expected to support 1.5 secondary jobs in the local economy. As shown in Table 5-17, the peak level operations work force of 400 will support about 600 secondary jobs. Note, however, that the total number of secondary employees indicated in Table 5-17 does not reflect the full application of the 1.5 service multiplier until the year 1987. This is due to the presence in the area work force prior to 1987 of secondary employees induced by construction-phase employment. Experience in similar projects has shown that, during the construction operations employment overlap period, secondary employment is not cumulative. Thus, the secondary employment supported by operations employment shown in Table 5-17 reflects the deduction of construction-induced secondary employment (see Table 5-14). It is also assumed that the peak number of construction-induced secondary workers will remain in the area after termination of the construction phase. Thus, of total operations-induced employment, at least 54 jobs will be filled locally. Of the remaining operations-induced secondary jobs, it is further assumed that 20 percent will be filled by local residents, and 80 percent will require in-migrant employees.

Income Effects. Primary and secondary income effects of operation and maintenance of the proposed mine flow from both labor and nonlabor expenditures. As shown in Table 5-18, average annual direct operations expenditures for Phase I are projected at $23.28 million dollars per year, in 1981 dollars. Average annual direct operations expenditures during Phase II will increase to $56.9 million. Salaries paid to local employees, exclusive of benefits, will amount to about 27 percent of the total. Wage levels range from about $60,000 per year for managerial staff to about $28,000 per year for skilled laborers, with an average wage of about $30,000 per year in 1981 dollars. Local secondary income to the area resulting from operations worker consumer expenditures is projected to average about $7.6 million annually from 1986-1992, and $14.1 million from 1993 to 2017. Assuming an income multiplier of 2.024 for the West South Central Region of the United States (Watson et al., 1977) and a 60 percent local expenditure capture rate.

Primary and secondary income effects will also accrue from projected annual expenditures for machinery, material, and other nonlabor requirements (see Table 5-18). Based on assumptions similar to those employed with regard to construction secondary income effects, it is estimated that approximately seven percent of machinery, materials, power, and fuels expenditures will be spent within the project area for a total of about

TABLE 5-18

ESTIMATED OPERATIONS AND MAINTENANCE EXPENDITURES

(thousands of 1981 dollars)

Cost Item	Average Operations and Maintenance year Phase I[a]	 Phase II[b]
Labor		
Direct Wage and Salary	$ 6,270.0	$ 11,600.0
Fringe and Benefits	1,254.0	2,320.0
Subtotal	$ 7,525.0	$ 13,920.0
Capital Expenditures (Machinery/Equipment, Materials, Power and Fuels)	8,500.0	22,500.0
Other		
Insurance Interest	6,355.0	18,000.0
Relocation of Structures and Unallocated General Expense	900.0	2,500.0
Subtotal	7,255.0	20,500.0
TOTAL	$ 23,280.0	$ 56,920.0

a. Phase I: 1986 - 1992.

b. Phase II: 1992 - 2017.

$658,000 per year during Phase I and $1,750,000 per year during Phase II of operations. Again, assuming a 2.024 regional income multiplier, a total of about $1.33 million (Phase I) and $3.54 million (Phase II) in annual local secondary income effects could result from nonlabor operations expenditures.

5.7.4.2 Population Effects

Of the peak level operations work force of 400, about 360 are expected to be in-migrants. Observations of energy project worker family characteristics have indicated that about 90 percent of operations workers are married, with an average family size of 3.59 persons (Denver Research Institute, 1979). At full operation of the mine, therefore, operations employees and their families will add a maximum of about 1,199 persons to the four-parish area population.

Similarly, it is assumed that 90 percent of secondary workers are likely to be married, with an average family size of 3.59 persons, and that about half of the married secondary workers will be married to each other. Under these assumptions, it is estimated that at peak level operations, secondary workers and their families will account for a maximum of 1,351 additional persons in the four-parish area population. Combined direct and secondary population effects of the operations phase amount to a total population increase of 2,550 persons (Denver Research Institute, 1979).

Using the locational method described in Section 5.7.3.2, above, the peak total operations-phase population increment was distributed among the four principal project area communities. This probable distribution is shown on Table 5-19, which also presents projected housing and water supply and wastewater system effects.

Typical energy related in-migrants will have a median age of 22 years, which is between two and four years lower than that of the existing population. Project operations workers will earn an average annual salary of about $30,000, compared with the average household income of between $7,762 and $14,854 in the project area (1981 dollars).

5.7.4.3 Housing

Approximately 70 percent of the in-migrating operations workers are expected to seek single family housing (Mountain West Research, Inc., 1975). Due to the projected rapid

TABLE 5-19

DISTRIBUTION OF PEAK OPERATIONS-PHASE POPULATION AND RELATED COMMUNITY EFFECTS[a]

Municipality	Estimated Distribution Rate (%)	Estimated Peak Operations-Related In-Migrant Population	Estimated Housing Demand (units)	Estimated Water Demand (MGD)[b]	Estimated Wastewater Demand (MGD)[b]
Mansfield	46.0	1,173	298	.182	.117
Many	10.0	255	65	.040	.025
Natchitoches	32.0	816	207	.126	.082
Coushatta	12.0	306	78	.047	.031
TOTALS	100.0	2,550	648	.395	.255

a. Peak operations employment occurs 1993-2017.

b. For conversion to metric units, see Conversion Table.

start up of the operations phase, providing adequate housing for operations workers would cause adverse impacts on the already low housing stocks in the area during the early years of operations. In the second half of 1985, the estimated 148 operations workers who will move to the area will require about 141 housing units, assuming 1.05 operations workers per household. Secondary workers induced by operations employment will require about 100 units, assuming 1.54 workers per household, for a total of 241 housing units. By peak level operations in 1993, total housing demand associated with primary and secondary employment will reach 648 units in the four-parish area. The probable distribution of this demand among project area communities is shown in Table 5-19. While current surveys reveal existing housing deficiencies in the area, short-term housing needs created during construction should stimulate housing growth. Additional housing generated during the construction period should be able to accommodate demands associated by the operations phase of this project.

5.7.4.4 Community Services and Facilities

Water and Wastewater Systems. Utility service demands associated with the proposed mine project are expected to increase with the beginning of the project operations phase. At the peak of operations, additional fresh water demands generated by operations-related new population will total about 1,495,075 liters (395,000 gallons) per day. Additional wastewater service demands will amount to about 965,175 liters (255,000 gallons) per day. Distribution of water and wastewater service demands is shown in Table 5-19. If existing problems discussed in Section 5.7.3.4 are not resolved during the construction phase of the project, similar adverse impacts generated during construction are also likely to occur during the operations phase.

Services. The total of 2,550 operations-related in-migrants could require some expansion of services in area communities. Based on the recommended service ratios prescribed in Section 5.7.3.4, above, and on estimated distribution rates shown in Table 5-19, as many as five policeman (two in Mansfield, two in Natchitoches, and one in Coushatta), two jail cells (one in Mansfield, and one in Natchitoches), five fire protection personnel (two in Mansfield, two in Natchitoches, and one in Coushatta), two doctors (one in Mansfield and one in Natchitoches), fifteen hospital beds (seven in Mansfield, one in Many, five in Natchitoches, and two in Coushatta), and twenty-five nursing home beds (twelve in Mansfield, two in Many, eight in Natchitoches, and three in Coushatta), would be required through the area.

The estimated 324 in-migrating operations worker families and 316 secondary worker families (peak level) may be expected to have 295 children and 288 children, respectively, or a total of 583 school-age children. Area wide, these children would require an additional 31 teachers (14 in Mansfield, 3 in Many, 10 in Natchitoches, and 4 in Coushatta) and 28 classrooms (13 in Mansfield, 3 in Many, 9 in Natchitoches, and 3 in Coushatta). Actual impacts on a single school district will depend on residential distribution throughout the area (see Section 5.7.5.4, below).

5.7.4.5 Government Finances

As shown in Table 5-20, the operations phase of the project will generate substantial tax revenues for the state, area parishes, school districts, and cities. The $47.0 million capital value of the proposed mine will be subject to De Soto Parish and school district ad valorem taxes. Based on 1981 tax rates and assuming 100 percent valuation (see Section 5.7.1.5), the mine facility could be assessed approximately $148,000 per annum in property taxes. Actual tax revenues over time will depend on future tax rates and assessment procedures. Ad valorem revenues of about $75,500 would accrue to local governments as a result of operations worker ownership of residential property.

Based on an average annual per capita taxable retail expenditure of $2,780 per person (LDNR, 1980) the population associated with project operation will add between $70,890 and $212,670 in local sales tax revenues annually, depending on the applicable tax rate. This is based on a peak in-migrant total (direct and secondary) population of 2,550.

5.7.4.6 Transportation

At peak level operations, the proposed mine work force will add about 667 vehicle trips per day along area arterials, assuming two trips per employee per day and 1.2 employees per vehicle. Because employees will work in three daily shifts, the additional trips generated will be spread over a 24-hour period. The estimated 648 new households (peak level) related to the operations phase will generate about 6,480 nonwork vehicle trips per day throughout the four parish area (Institute of Traffic Engineers, 1979). Using the estimated distribution rate shown in Table 5-19, these nonwork trips may be distributed among the area municipalities as follows: Mansfield, 2,980; Many, 648; Natchitoches, 2,074; and Coushatta, 778. In addition, mine operations will require approximately one commercial delivery trip per day. While project-related ADT levels will adversely impact

TABLE 5-20

ADDITIONAL LOCAL ANNUAL TAX REVENUE GENERATED BY THE PROPOSED DOLET HILLS MINE PROJECT

OPERATIONS PHASE

Form of Tax	Tax Base	Tax Rate (mills)	Estimated Additional Revenue (1981 dollars	Local Governments Benefitting From Tax
Ad Valorem Tax	$47.0 million Capital value of mine (1981 dollars)	31.47[a]	$ 147,909[b]	De Soto Parish & school district[c]
	Additional valuation of project employees property	Varies	$ 75,489[d]	Project area parishes and school districts
Sales Tax	Retail expenditures of project-related population	1-3 percent depending on overlapping tax jurisdictions	$70,890-$212,670	Project area school districts; cities of Coushatta and Natchitoches
TOTAL			$294,288 $436,068	

a. 1981 tax rate.

b. Assuming 100 percent market valuation.

c. 98.4 percent of proposed mine site lies within DeSoto parish.

d. $62.96 ad valorem tax revenue per direct employment-related in-migrant population.

Source: LDNR, 1980.

the existing project area transportation network, the opening of I-49 in the later part of the 1980's should lessen the impact. In addition, a by-pass around the southeast side of Mansfield between LA 175 and U.S. 84 has been authorized by the Louisiana Dept. of Transportation and Development and should be constructed in the mid-1980's (Shaeffer, 1982). This would lessen secondary adverse impacts on area roads.

Work-related vehicle access to the mine site will be over three principal arterials: LA 175 (western mine area), LA 177 (eastern mine area), and U.S. 84 (administration office and workshops).

A small portion of LA 522 may be relocated which would result in disruption of traffic over that roadway for a short-term period. Disruption of traffic (less than eight hours) will also occur twice during the project around the year 2000 to move a dragline across LA 175. The construction of the conveyor system across LA 175 may also create a short-term disruption of traffic.

5.7.4.7 Recreational Facilities and Aesthetics

In-migrating population associated with the operations phase of the proposed mine will create additional demands on the already strained recreational facilities in the area. Urban recreational areas are presently in need of more playgrounds and playfields (CDC, 1981).

Mansfield Battle Park, adjacent to the west boundary of the permit area, will be indirectly adversely impacted visually by clearing, mining, and reclamation activities around the year 2003. Similarly, vehicle traffic on LA 175, 522, 346 and other minor roadways will be subjected to adverse visual impacts of mining operations for periods of time during the life of mine.

5.7.5 Combined Power Plant and Mine Impacts

5.7.5.1 Labor Force

The combined labor force for the power plant and mine projects (including direct and secondary employment for both construction and operations phases) is expected to increase appreciably in the latter half of 1982, when major construction of the power plant is scheduled to begin. Combined employment associated with the two projects will increase steadily to a peak of 1,449 jobs in the second half of 1985, when the power plant construction force and the mine operation force overlap. With the completion of power plant construction in 1986, the combined labor force will begin to drop between 775-800 by the early 1990's. Phase II of the mining operations, scheduled to begin in 1993, will require additional employees. The combined labor force of 1,250 resulting from these new employees should remain stable through the remaining years of the project life. Combined labor force projections are shown in Table 5-21.

5.7.5.2 Population

Combined power plant-mine population effects are shown in Table 5-22. In-migration related to the two projects is expected to increase steadily from late 1982 until late 1985, when concurrent plant construction and mine operations activities will generate a population increment of about 2,963 persons. The number of project-related in-migrants will decline thereafter to a relatively stable level of about 1,794 persons, but will increase to a peak of 3,023 persons as a result of Phase II of mining operations.

The significance of these projected population effects upon the four-parish area lies in the probable distribution of combined project-related peak in-migration among the principal communities within a 30-mile radius. This distribution was calculated using the methodology described in Section 5.7.3.2 above. The distribution calculations indicated that, of the total combined construction and operations-related peak population increment, 46 percent would live in Mansfield, 32 percent in Natchitoches, 12 percent in Coushatta, and 10 percent in Many. The estimated distribution of population and related housing and water and wastewater effects is shown in Table 5-23.

5.7.5.3 Housing

Associated housing demands could create severe adverse impacts on the area's already deficient housing supply. As indicated in Table 5-23, the largest population impacts, and hence the largest housing demands, are anticipated to occur in the communities of Mansfield and Natchitoches. Peak level housing demand in Mansfield is projected at about 356 units. However, housing development activity in and around Mansfield has already begun to respond to the anticipated demand associated with the several industrial projects in the area. According to the CDC preliminary housing study (1981), most of the housing

TABLE 5-21

COMBINED POWER PLANT AND MINE CONSTRUCTION AND OPERATIONS EMPLOYMENT EFFECTS[a]

1982 - 2017

Year/Half	Power Plant Employment			Mine Employment			Combined Employment		
	Residents	In-Migrants	Total	Residents	In-Migrants	Total	Residents	In-Migrants	Total
1982.1	--	--	--	3	8	11	3	8	11
1982.2	74	196	270	2	5	7	76	201	277
1983.1	118	314	432	2	5	7	120	319	439
1983.2	148	392	540	13	36	49	161	428	589
1984.1	227	592	819	13	36	49	240	628	868
1984.2	248	610	858	33	88	121	281	698	979
1985.1	308	664	972	33	88	121	341	752	1,093
1985.2	322	678	1,000	96	353	449	418	1,031	1,449
1986.1	130	228	358	103	433	536	233	661	894
1986.2	100	150	250	103	433	536	203	583	786
1987-1991	100	150	250	95	430	525	195	580	775
1992	100	150	250	96	437	533	196	587	783
1993-2017	100	150	250	171	829	1,000	271	979	1,250

a. Includes direct and secondary employment.

TABLE 5-22

COMBINED POWER PLANT AND MINE CONSTRUCTION AND OPERATIONS POPULATION EFFECTS[a]

1982 - 2017

Year/Half	Power Plant			Mine			Combined		
	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total
1982.1	--	--	--	11	12	23	11	12	23
1982.2	253	276	529	7	6	13	260	282	542
1983.1	405	444	849	7	6	13	412	450	862
1983.2	506	553	1.059	46	52	98	552	605	1,157
1984.1	772	829	1,601	46	52	98	818	881	1,699
1984.2	832	829	1,661	114	124	238	946	953	1,899
1985.1	1,012	829	1,841	114	124	238	1,126	953	2,079
1985.2	1,059	829	1,888	559	516	1,075	1,618	1,345	2,963
1986.1	401	282	683	650	677	1,327	1,051	959	2,010
1986.2	300	173	473	650	677	1,327	950	850	1,800
1987-1991	300	173	473	630	694	1,324	930	867	1,797
1992	300	173	473	639	706	1,345	915	879	1,794
1993-2017	300	173	473	1,199	1,351	2,550	1,370	1,524	3,023

a. Includes primary and secondary employment and families.

TABLE 5-23

DISTRIBUTION OF PEAK COMBINED POWER PLANT AND MINE POPULATION AND RELATED COMMUNITY EFFECTS 1985[a]

Municipality	1980 Population[b]	Estimated Distribution Rate (%)	Project-Related Population[c]	Estimated Housing Demand (units)	Estimated Fresh Water Demand (MGD)[d]	Estimated Wastewater Demand (MGD)[d]
Mansfield	6,485	46.0	1,391	356	.216	.139
Many	3,988	10.0	302	77	.047	.030
Natchitoches	16,664	32.0	967	247	.150	.097
Coushatta	2,084	12.0	363	93	.056	.036
TOTAL	29,221	100.0	3,023	773	.469	.302

a. Peak in-migration is expected to occur in 1993, when Phase II of mining operations begins.

b. Source: U.S. Dept. of Commerce, Bureau of Census, 1981.

c. Includes direct and secondary.

d. For conversion to metric units, see Conversion Table.

developments planned within the project area are within 16.1 kilometers (10 miles) of Mansfield. The City of Natchitoches is expected to receive about 967 combined project-related new residents (peak level), requiring about 247 additional housing units. It is anticipated that the existing Natchitoches housing market will be better able to accommodate this relatively small demand increment than other impacted communities. Combined project-related new residents to the town of Coushatta represent a demand for about 93 new units of housing. Unless similar housing developments occur, this project-related population influx will place severe demands on Coushatta's housing supply.

5.7.5.4 Community Services and Facilities

Combined project-related demands on project area services and facilities will steadily increase from the start of power plant construction in 1982. Combined project in-migration is expected to reach an early peak of 2,963 persons in late 1985, decline somewhat thereafter, then increase in 1993 to a relatively stable peak level of about 3,023 persons. Rapidly increasing service demands through the 1985 peak year may cause temporary dislocations in some communities. However, the relative stability of the below-peak demand from 1986 through 1992 should allow area jurisdictions to adequately plan and finance the system and service expansions needed to accommodate the peak-level demand from 1993 through the project life. It should be noted that although the plant construction and mine operations work forces overlap during 1985, the near peak population effects after 1986 will continue throughout the operations phase of both projects. Thus, planned responses to community service demands will be largely predicated on operations phase effects alone.

Water and Sewerage Systems. As shown in Table 5-23, the combined power plant- and mine-related demands on water supply and wastewater systems will be greatest in Mansfield and Natchitoches. In Mansfield, peak-level (1993) freshwater demand will require about 48 percent of the projected 1990 unused system capacity, according to CDC (1982) estimates. Although reliable data on unused wastewater treatment capacity were not available, calculations based on Mansfield's existing user population indicate that peak wastewater demand will equal about 57 percent of the 1990 unused treatment capacity of the Mansfield system. In Natchitoches, similar calculations indicate that peak-level freshwater demands will amount to about three percent and six percent of estimated 1982 unused capacities of the freshwater and wastewater treatment systems. While the unused treatment capacities of the Natchitoches water supply and wastewater treatment systems may be expected to decline by 1990, the expected project-induced demand does not appear to represent a significant problem to existing water and wastewater treatment system capacities.

Similar calculations based on current user populations indicate that peak-level water and wastewater demands for the town of Many would require about 12 percent and 15 percent of the existing unused treatment capacity in the towns water supply and wastewater systems. As stated earlier, the town of Coushatta's existing water supply and wastewater systems are in deficit capacity condition. Any additional demand on these systems, including the in-migrating population associated with the combined project, will adversely affect Coushatta's utility system. It should be noted, that plant treatment capacity alone is not an adequate measure of the ability of municipal systems to accommodate growth. In Many, for example, some of the water supply mains are undersized and in poor condition. Similarly, the water supply systems in both Mansfield and Natchitoches have current storage deficits, according to state standards. (See Section 5.7.1.4 for further detail on existing system conditions and capacities.)

Services. Initial high service demands associated with the power plant and mine will occur during 1985, decline slightly from 1986 to 1992, and stabilize at peak level from 1993 through the project life. Based on the assumptions stated in Section 5.7.3.4, above, peak-level in-migration will create a need for as many as six additional law enforcement officers, three jail cells, six firemen, three doctors, eighteen hospital beds, and thirty nursing home beds throughout the four-parish area. Based on the projected distribution of project-related in-migration among the four principal communities (Table 5-23), the City of Mansfield may require the addition of three policemen, one jail cell, three firemen, one doctor, eight hospital beds, and fourteen nursing home beds during the period of peak in-migration. School-age children associated with in-migration to Mansfield may require up to fifteen additional classrooms and seventeen additional teachers.

Under the same population distribution assumptions, the City of Natchitoches may require two additional policemen, one additional jail cell, two firemen, six additional hospital beds, ten nursing home beds, eleven classrooms, and twelve teachers as a result of project-related in-migration at its peak. Similarly, the towns of Many and Coushatta may each require the addition of two hospital beds, three nursing home beds, four to five classrooms and four to five teachers.

5.7.5.5 Local Government Finances

The cost of providing the projected services and facilities described above will be borne by the various local government entities in the four-parish area, with the cities of Mansfield and Natchitoches bearing most of the impacts. The financial effects on Many and Coushatta will be smaller, although not insignificant due to these towns relatively smaller tax bases and revenue-generating capabilities. Certain public expenditures are likely to be incurred prior to the realization of public revenues associated with the power plant and mine projects. As discussed earlier in Section 5.7.4.5 and Table 5-20, local governments in the four-parish area may expect to realize combined project-related revenues from property and sales taxes. Based on Louisiana State Planning Office data, property tax revenues associated with the peak project-related population (1985) is expected to total about $183,000. Annual property tax revenues received from project-related population will decrease to about $108,700 (1981 $'s) by 1992, but will increase to about $147,800 (1981 $'s) throughout the remainder of the project. At current mill rates, De Soto Parish and school district may realize up to about $1.7 million annually in ad valorem taxes associated with the estimated combined capital value of the mine itself. Assuming a one percent sales tax levied by parish school boards, sales tax revenues may be expected to generate up to about $48,000 annually during project operations.

5.7.5.6 Transportation

Significant work-related traffic effects of the combined projects will occur at the peak of construction in 1985, when 750 plant construction workers and 112 mine construction workers will generate about 1,430 work-related trips per day on project-vicinity arterials (assuming two trips per day and 1.2 workers per vehicle). The addition of these vehicle-trips to existing traffic levels will adversely impact the use of the project vicinity's existing road system. Construction of I-49 near the project site is also scheduled to occur during this time period (1984-1986), compounding the overall adverse affects on area traffic. Between 1986 and 1993, work-related traffic associated with the operations phases of the two projects will drop to about 620 trips per day. Work-related vehicle trips will then increase to about 932 per day throughout the remainder of the project. Nonwork-related traffic impacts associated with combined project in-migrants is expected to stabilize after 1993 at about 6,480 trips per day distributed throughout the four-parish project area. Given the predicted distribution of combined project-related in-migrants (see Section 5.7.5.2, above) the total number of nonwork-related vehicle trips per day may be expected to occur over arterial and feeder roads and city streets in and around the four municipalities approximately as follows:

City	Trips Per Day
Mansfield	2,981
Many	648
Natchitoches	2,074
Coushatta	778

Completion of I-49 will somewhat alleviate adverse impacts created at this time.

5.7.5.7 Recreation

Project-area recreational resources will be affected by increased visitation associated with both plant- and mine-related population growth. Mansfield Battle Park is likely to experience a relatively large share of combined project-related recreational impacts. The project area has been designated a "moderate need" area by the Louisiana State Parks and Recreation Commission. Plant and mine direct and secondary workers and their families may generate a noticeable increase in recreational demand particularly in the Mansfield area.

5.8 LAND USE

5.8.1 Existing Environment

5.8.1.1 Land Use of the Permit Area Region

The regional study area includes Bienville, Bossier, Caddo, Claiborne, De Soto, Lincoln, Natchitoches, Red River, Sabine, and Webster parishes, which are component parts of State Planning District 7 in northwestern Louisiana. The regional study area comprises approximately 2,091,596 hectares (5,168,262 acres), of which 70.5 percent is forestland, 20.8 percent is agricultural land, 2.7 percent is water, 2.4 percent is wetlands, 3.1 percent is urban, and 0.3 percent is classified as barren (Louisiana State Planning Office, 1975).

The land use of the 10-parish project region has been discussed in the Dolet Hills Power Plant Project Draft EIS (EPA, 1981).

5.8.1.2 Land Use of the Project Area

The project area consists of De Soto, Natchitoches, Sabine, and Red River parishes, each of which is located within eight kilometers (five miles) of the permit area boundary (i.e., the secondary potential impact area). Forested and agricultural lands comprise 69.5 percent and 25.1 percent, respectively, of the 2.2 million total four-parish acreage (Louisiana State Planning Office, 1971; SCS, 1977).

Of the approximately 0.6 million hectares (1.6 million acres) of commercial forestland in the project area, 30 percent is controlled by the forest industry, including more than 44,517 hectares (110,000 acres) of commercial forest plantation (University of New Orleans, 1977). About 43 percent of the commercial forestland consists of loblolly-shortleaf pine, and forest stand size classes are dominated by sawtimber and poletimber, respectively. Between 1969 and 1979, the area produced an average of 14 percent of the statewide pulpwood. De Soto Parish has one small and several large sawmills, including a newly constructed International Paper Company wood products plant in Mansfield and a Georgia Pacific plant in Logansport.

In the four-parish project area, prime farmland (as defined by the SCS; see Section 5.1.3.1) accounts for 247,408 hectares (611,337 acres) or 27.5 percent of the total land area. However, only 173,811 hectares (429,482 acres) or 70.2 percent of that farmland are available for agriculture. A total of 30,389 hectares (75,091 acres) of SCS prime farmland in the four-parish area is devoted to non-agricultural use, including 29.9 percent urban, 23.2 percent government lands, 0.6 percent rural extraction, and 46.2 percent rural transportation (Ramsey and Corty, 1982).

Dominant agricultural crops in the project area include soybeans, cotton, sorghum, corn, and wheat. From 1964-1978, the area produced an average of 4.7 percent of the State's annual cotton crop, about 9.0 percent of the annual sorghum crop, and about 1.6 percent of the annual soybean crop (Louisiana State University, 1978a, 1978b, 1979).

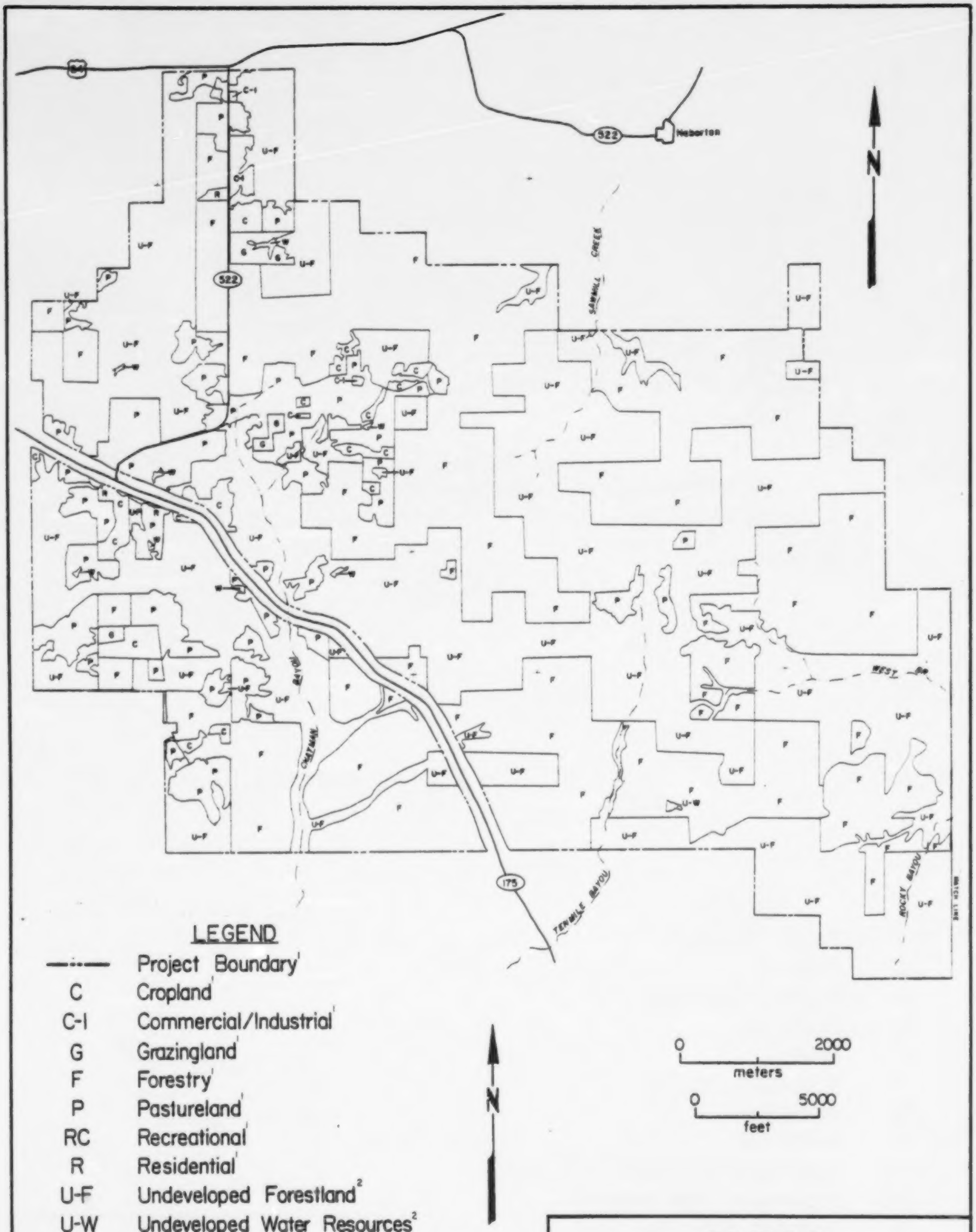
5.8.1.3 Land Use of the Permit Area

The predominant land uses within the 11,968-hectare (29,573-acre) permit area in De Soto Parish are undeveloped forestland and developed forestland comprising 50.5 percent and 40.4 percent, respectively, of the total acreage (Figure 5-6 (a and b) and Table 5-24). Undeveloped forestland is not actively managed, and planting and harvesting patterns are not evident on aerial photography.

Only 1.1 percent or 131.6 hectares (325.3 acres) of the agricultural land within the permit area boundaries is directed toward crop production. The remainder is used for pasture and livestock. The three principal cash crops in the permit area are cotton, sorghum, and soybeans. Considerable fluctuations in the dominant crops of the project region have occurred during the last 10 years. In 1970, cotton was the principal crop in terms of acres planted, followed by soybeans and sorghum. By 1979, however, the more profitable soybeans had far overshadowed both cotton and sorghum.

A recent in-house structure survey by the applicant revealed the presence of approximately 210 occupied dwellings, 3 churches, and 6 cemeteries within the permit area boundaries (SWEPCO/CLECO, 1980). Approximately 22 hectares (54.2 acres) of the proposed permit area are classified as commercial/industrial land use.

Five major pipelines traverse the permit area. Louisiana Interstate Gas Corporation operates four natural gas lines. Three are located approximately six meters (20 feet) apart and oriented in an east-west direction through the permit area, and one that transects the southwestern portion of the area. Scurlock Oil Company operates a crude oil line that transects the approximate center of the area. The Scurlock line currently transports over 3,000 barrels of crude oil daily, most of which is recovered secondarily from three water-flood projects of Sun Production Company. A recent inventory of Louisiana Department of Conservation records indicated that there are approximately 60 producing oil and gas wells within the boundaries of the permit area (Porter, 1980). There are also a number of abandoned wells and pipelines in the permit area. With the exception of the three water-flood projects of Sun Production Company, the oil and gas wells in the area are low volume producers, normally gathering less than 10 barrels per day or 72 thousand cubic feet (mcf) per day, respectively (Porter, 1980).


84
522
522
175
SAWMILL CREEK
CHATMAN BAYOU
TENMILE BAYOU
WEST BR
ROCKY BAYOU
MATCH LINE
N
N
0
2000
meters
0
5000
feet

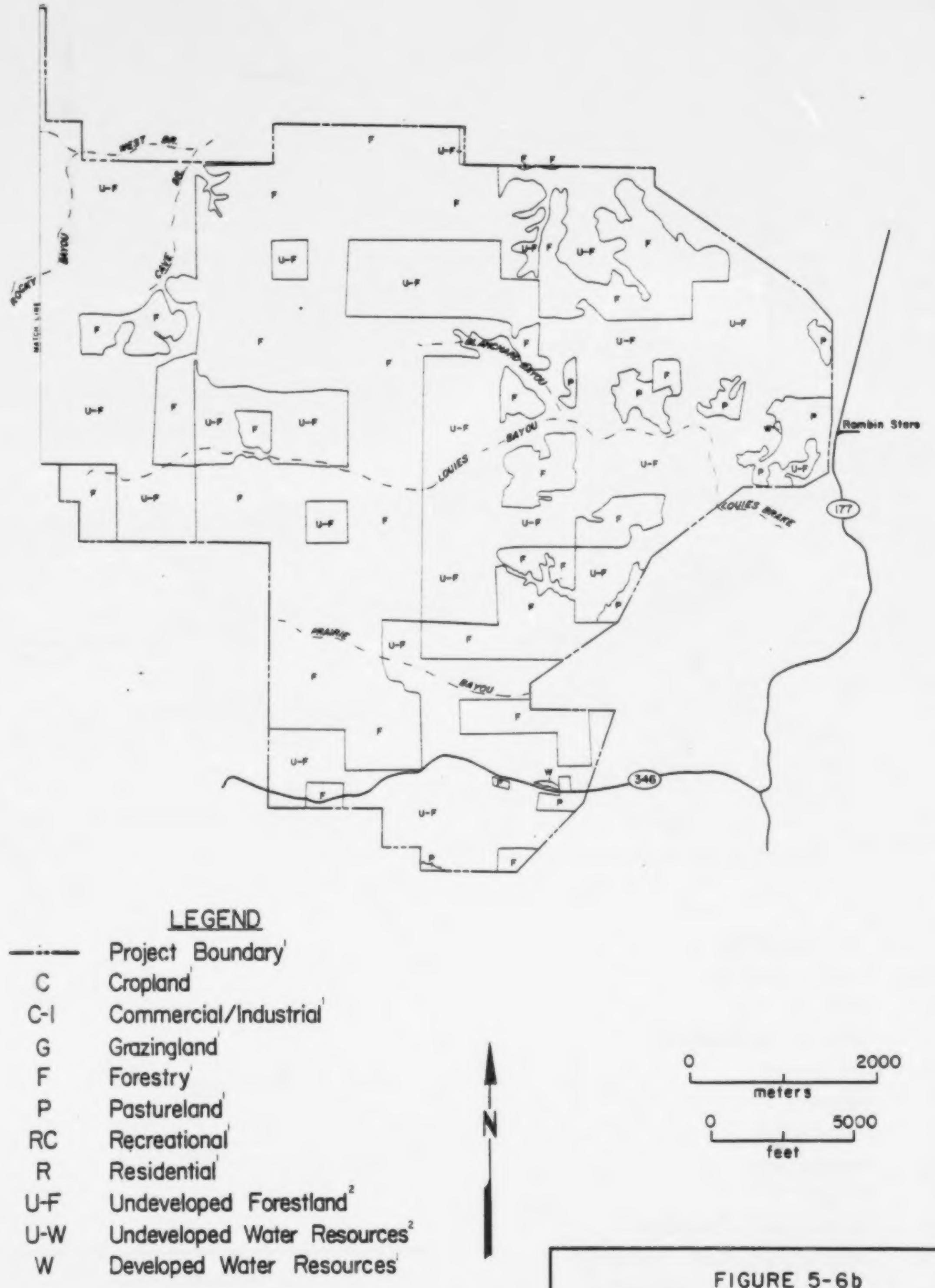
LEGEND

—·-·—	Project Boundary[1]
C	Cropland[1]
C-I	Commercial/Industrial[1]
G	Grazingland[1]
F	Forestry[1]
P	Pastureland[1]
RC	Recreational[1]
R	Residential[1]
U-F	Undeveloped Forestland[2]
U-W	Undeveloped Water Resources[2]
W	Developed Water Resources[1]

FIGURE 5-6a
LAND USE OF THE PERMIT AREA
West Area

SOURCE: EH&A

[1] Based upon 30 CFR Section 701.5
[2] Adapted from Undeveloped Category (30 CFR Section 701.5)


WEST BR.
ROCKY BAYOU
CAVE BR.
MATCH LINE
BLANCHARD BAYOU
LOUIES BAYOU
LOUIES BRAKE
PRAIRIE BAYOU
Rambin Store
177
346
F
P
U-F
W
LEGEND
Project Boundary[1]
C Cropland[1]
C-I Commercial/Industrial[1]
G Grazingland[1]
F Forestry[1]
P Pastureland[1]
RC Recreational[1]
R Residential[1]
U-F Undeveloped Forestland[2]
U-W Undeveloped Water Resources[2]
W Developed Water Resources[1]
N
0 2000
meters
0 5000
feet

[1] Based upon 30 CFR Section 701.5

[2] Adapted from Undeveloped Category (30 CFR Section 701.5)

FIGURE 5-6b

LAND USE OF THE PERMIT AREA

East Area

SOURCE: EH&A

TABLE 5-24

EXISTING LAND USE OF THE DOLET HILLS MINE PROJECT[a]

	Total Permit Area			Area to be Mined		
	Hectares	Acres	Percent	Hectares	Acres	Percent
Undeveloped Forest	6,048.7	14,946.2	50.5	2,883.5	7,125.1	46.1
Developed Forest	4,840.6	11,961.1	40.4	2,655.1	6,560.7	42.4
Pastureland	870.4	2,150.8	7.3	600.6	1,484.2	9.6
Cropland	126.1	311.5	1.1	79.1	195.4	1.2
Grazingland	40.4	99.9	0.3	31.9	78.9	0.5
Water	13.0	32.1	0.1	3.8	9.3	0.1
Residential	7.0	17.2	< 0.1	2.5	6.2	< 0.1
Commercial-Industrial	21.9	54.2	0.2	2.5	6.2	< 0.1
TOTAL	11,968.1	29,573.0	100.0	6,259.0	15,466.0	100.0

a. Classifications are from LSMR 100.5(58); forestry is further designated as developed/undeveloped by EH&A.

Three major electric power transmission lines, one 34.5 kV and two 138 kV, traverse the area. These lines are operated by CLECO. Also, two rural water distribution systems operate within the area, the East De Soto Water System along State Highway 522 in the northwest portion of the project site and the Wallace-Rambin Water System near State Highway 346 in the southeast portion of the site.

5.8.2 Impacts of No Action Alternative

The no action alternative would eliminate the adverse impact of construction and operation related to the Dolet Hills Lignite Mine Project. Land-use trends in the permit area are expected to follow a similar pattern to those now occurring should the "no action" alternative be adopted. Industrial growth (i.e., manufacturing, other energy-related developments) will likely increase the conversion and loss of agricultural land including undeveloped forestland and pastureland. Increased industrial development will further contribute to greater urbanization as population in-migration becomes evident. Secondary impacts as a result of the no action alternative will also result in increased urbanization.

5.8.3 Impacts of Construction

The Dolet Hills Lignite Mine Project will convert approximately 253 hectares (625 acres) of primarily developed and undeveloped forestland to industrial use, an adverse impact for life of the project, after which ancillary facilities will be dismantled and the area will be reclaimed according to landowner preference. Project construction activities which could affect land uses include relocation of pipelines, roads, streams, and transmission lines; and construction of haul roads, conveyor system and ancillary facilities. Lignite will be recovered from the mostly forested mining blocks incremently over the life of the mine and mined areas will be reclaimed immediately after backfilling is completed. Thus, individual mining blocks are considered to be adversely impacted by this short-term industrial use.

The proposed haul roads and conveyor system will disturb an estimated 70.8 hectares (175 acres), and 65.6 hectares (162 acres), respectively, of largely undeveloped forestland. Major ancillary facilities include the main office block and field workshops and encompass a total of 72.8 hectares (180 acres), 11 percent of which is pastureland and the remaining 89 percent undeveloped forestland. There will be three dragline erection sites covering

4.5 hectares (11 acres), 65 percent of which is developed forestland and 35 percent is undeveloped forest.

Additional indirect adverse land-use impacts of project construction within the four-parish area include land-use changes resulting from residential construction and associated utilities installation for construction-related in-migrants. These impacts will primarily impact forested areas, which constitute the majority of land in the area.

5.8.4 Impacts of Operation

Of the total 11,968-hectare (29,573-acre) permit area, 6,259 hectares (15,466 acres) will be directly affected by mining, which constitutes a short-term adverse impact. The relative acreages of the various land uses to be disturbed by mine operation are contained in Table 5-24. Because mining will not occur over the entire project site simultaneously, but rather in individual mining blocks over the course of 32 years, land uses will be affected on an incremental basis. An average of 195.5 hectares (483 acres) will be mined on an annual basis for the life of the mine (1986-2017). When including all of the clearing, mining, and reclamation activities during full lignite production (1985-2017), an average of 280.5 hectares (693 acres) will be disturbed annually.

There are an estimated 140 dwellings, one church, and one cemetery located within the proposed mining blocks. These will be adversely affected. The additional 70 dwellings, two churches, and five cemeteries located with the permit area will be indirectly adversely affected because of their proximity to mining activities. However, all cemeteries in the mining area will be avoided. No mining activity will approach within 30.4 meters (100 feet) of a cemetery in compliance with LSMR 161.11, and access will always be provided to the cemeteries. At some time during the life of the project, a small section of LA 522 in the northern portion of the mine may be relocated, which would result in a short-term impact. In addition, there will be a temporary disruption (estimated to be less than eight hours) of traffic on LA 175 in the western portion of the mine. This will occur twice during the project around the year 2000 to move a dragline, and will represent an adverse short-term impact. A conveyor system will cross LA 175 until the far southwestern section of the permit area has been mined, possibly resulting in a disruption of traffic during construction, which would be a short-term impact. The method for crossing the highway has not been determined. The highway relocation, dragline crossings, and the conveyor crossing will be coordinated with the Louisiana Department of Transportation and Development, Office of Highways.

The five pipelines found in the permit area will be relocated prior to mining. Schedule and procedure for all relocations will be undertaken through agreement with pipeline operators. Service of the estimated 60 oil and gas wells located inside the permit area will be discontinued during mining activities and resumed following reclamation at the well operator's direction. Water lines associated with the East De Soto Water System in the northwest portion of the project site and the Wallace-Rambin Water System in the southeast portion of the site near State Highway 346 will be relocated as necessary.

The removal of approximately 2,655 hectares (6,560 acres) of commercial forestland from production in the proposal mining blocks can be assessed by estimating production and value of standing pine on the site. Potential production for De Soto Parish is estimated at two cords per acre per year of pine pulpwood, or 500 to 1,000 board feet per acre per year of pine sawtimber. Values (1981 dollars) are estimated to be $12 to $18 per cord or $200 to $280 per 1,000 board feet. Therefore, a loss of $157,440 to $1,836,800 per year is possible due to the proposed project (Louisiana Dept. of Natural Resources, Office of Forestry, 1981). The lesser figure assumes 100 percent utilization of forested areas for pulpwood, while the higher figure assumes 100 percent utilization for sawtimber. At the present time, approximately 70 percent of the commercial forestland within the permit area is suitable for pulpwood production, and 30 percent is mature enough for sawtimber.

5.8.5 Combined Impacts

The Dolet Hills Mine and Power Plant and associated transportive facilities will convert approximately 1,380 hectares (3,410 acres) of primarily developed and undeveloped forestland to long-term industrial use. An estimated 5,543 hectares (13,696 acres) of developed forestland valued at approximately $328,700 for pulpwood to $3,834,900 for sawtimber will be lost. Usable timber will be removed and sold prior to project development. After reclamation, the 11,968-hectare (29,573-acre) mine permit area will be comprised of 88 percent managed and unmanaged forests.

Additional adverse impacts to the project region will result due to increased urbanization associated with in-migration of project construction and operation workers and their families. Residential construction and utility installation will result.

5.9 CUMULATIVE IMPACTS

The Dolet Hills Lignite Mine Project is assessed "cumulatively" with certain other existing and planned lignite mines and/or power plants in the region (Figure 5-7). Those disciplines included in this cumulative impacts analysis are soils, ground water, surface water, air quality, ecology, socioeconomics, land use, and cultural resources. In some cases, the geographic influence upon the particular disciplines will vary.

Those projects considered in the cumulative impacts analysis are as follows: the Oxbow Mine and related Big Cajun No. 3 Power Plant, located in De Soto, Red River, and Natchitoches parishes, Louisiana, occupying 7,562 hectares (18,687 acres); the Castor Bayou Mine, located in De Soto Parish, Louisiana, occupying 4,533.6 hectares (11,200 acres); the Henry W. Pirkey Power Plant and related South Hallsville Surface Lignite Mine, located in Harrison County, Texas, occupying 9,665 hectares (23,822 acres); and the Martin Lake Lignite Mine (Area D), located in Rusk County, Texas, occupying 6,718 hectares (16,600 acres). Additional mining operations have been conducted at Martin Lake but no information is available. The Big Cajun No. 4 Power Plant and the Chicot Lignite Mine are also in the region, however, little or no public information is currently available. The applicant's proposed project, the Dolet Hills Lignite Mine Project, is located in De Soto Parish, Louisiana, and occupies 11,968 hectares (29,573 acres). The related power plant occupies 715.5 hectares (1,768 acres).

5.9.1 Soils

Seven Louisiana parishes and two Texas counties were considered in this cumulative impacts assessment: Bienville, Bossier, Caddo, De Soto, Natchitoches, Red River, and Sabine parishes, and Harrison and Rusk counties.

In the seven-parish/two-county area, approximately 629,930 hectares (1,556,535 acres) of land are designated as SCS prime farmland (43 FR Section 657.56) out of a total of 2,038,009 hectares (5,035,852 acres). Prime farmland represents 31 percent of the total acreage (both parishes and counties). Prime farmland that is being used for nonagricultural purposes in the seven-parish area represents 14.4 percent of the total SCS-designated prime farmland; no data is presently available for the two Texas counties mentioned (Table 5-25).

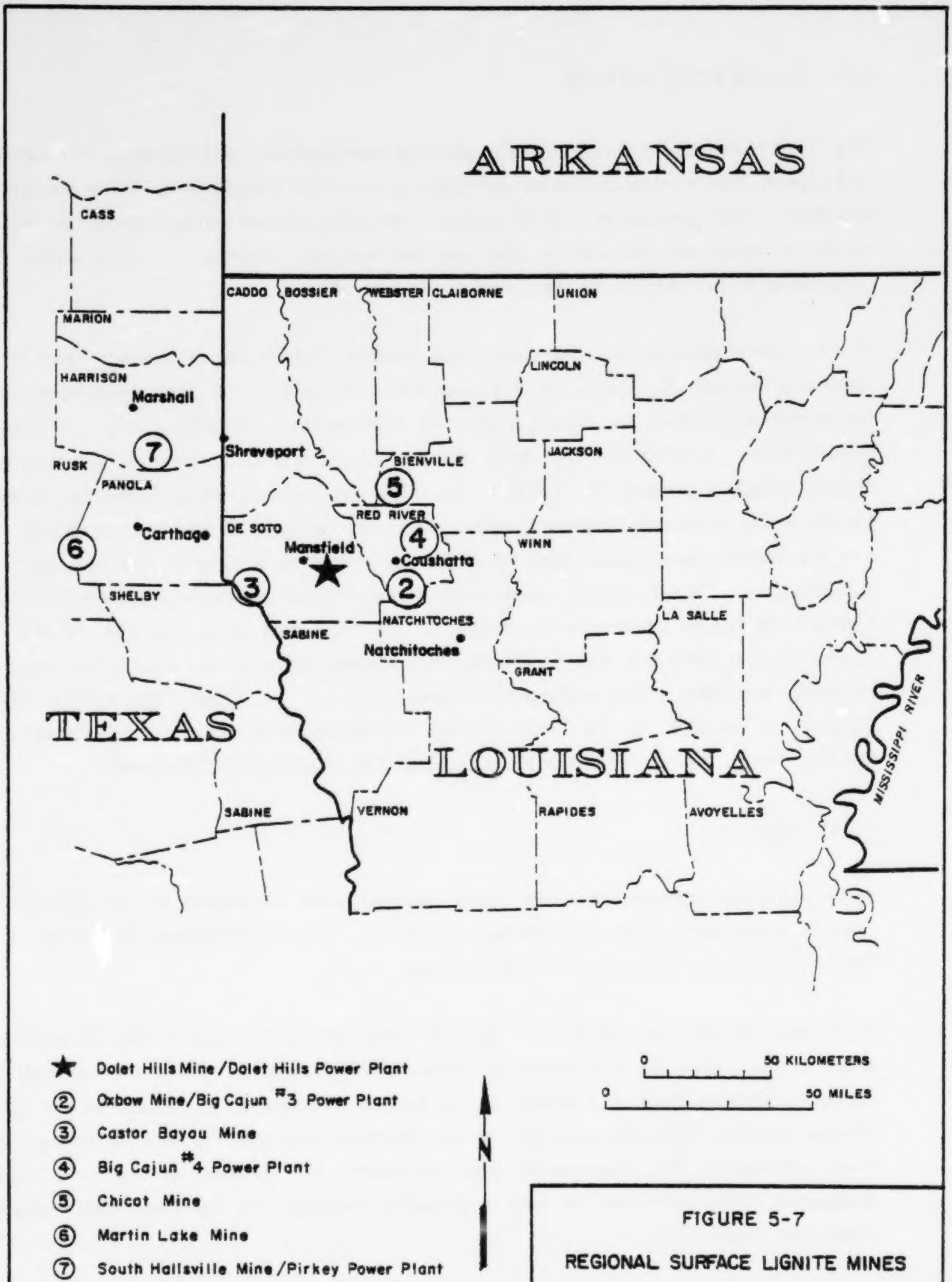

ARKANSAS
CASS
MARION
HARRISON
Marshall
RUSK
PANOLA
Carthage
SHELBY
Shreveport
CADDO
BOSSIER
WEBSTER
CLAIBORNE
UNION
LINCOLN
JACKSON
BIENVILLE
RED RIVER
DE SOTO
Mansfield
Coushatta
WINN
NATCHITOCHES
Natchitoches
SABINE
GRANT
LA SALLE
TEXAS
LOUISIANA
SABINE
VERNON
RAPIDES
AVOYELLES
MISSISSIPPI RIVER
①
②
③
④
⑤
⑥
⑦
★ Dolet Hills Mine / Dolet Hills Power Plant
② Oxbow Mine / Big Cajun #3 Power Plant
③ Castor Bayou Mine
④ Big Cajun #4 Power Plant
⑤ Chicot Mine
⑥ Martin Lake Mine
⑦ South Hallsville Mine / Pirkey Power Plant
N
0
50 KILOMETERS
0
50 MILES

FIGURE 5-7

REGIONAL SURFACE LIGNITE MINES AND POWER PLANTS

SOURCE: EH&A

TABLE 5-25

PRIME FARMLAND BY PARISHES IN THE VICINITY OF THE DOLET HILLS LIGNITE MINE PROJECT

Parish/County	Total Land Area (acres)[a]	Designated Prime Farmland (acres)[b]	Percent of Total Land	Nonagricultural Use		Percent of Total Prime Farmland
				Urbanized	Other[c]	
Bienville	531,900	122,708	23.1	5,187	9,182	11.7
Bossier	540,260	292,982	54.2	20,254	17,682	13.0
Caddo	575,360	263,108	45.7	51,870	12,777	24.6
DeSoto	572,160	122,279	21.3	6,669	8,215	12.6
Natchitoches	826,880	268,933	32.5	5,928	27,674	12.5
Red River	259,840	146,904	56.5	2,223	4,937	4.9
Sabine	558,720	73,221	13.1	2,074	11,263	25.8
Harrison	581,434	144,900	24.9	nd[d]	nd	nd
Rusk	589,298	121,500	20.6	nd	nd	nd
TOTAL	5,035,852	1,556,535	30.9	94,205	91,730	14.4

a. For conversion to metric, see Conversion Table.

b. Based on SCS criteria.

c. Includes Federally or State owned; rural extractive uses; and rural transportation systems.

d. nd = no data.

Source: Ramsey and Corty, 1982; Wheeler, 1982.

Acreages of SCS prime farmland which exist within the boundaries of the proposed project and other proposed surface lignite mines/associated facilities in the region are presented in Table 5-26. A total of 18,602 hectares (46,506 acres) of SCS-designated prime farmland would potentially be adversely affected by the proposed projects. This constitutes approximately three percent of the total prime farmland in the region of the Dolet Hills Lignite Mine Project.

5.9.2 Ground Water

Within 96.5 kilometers (60 miles) of the proposed Dolet Hills Lignite Mine Project, there are at least five proposed or currently active surface mining operations of the same class size. At each mine, significant thicknesses of Wilcox Group sediments will be disturbed for lignite extraction over an approximate 30-year period.

In general terms, the ground-water systems at each of these projects are very similar, as they are all subject to similar structural and stratigraphic controls. The ground-water impacts associated with each operation are anticipated to be about the same as those described for the Dolet Hills Mine; extending a distance of not more than .8 kilometers (.5 mile) from a project's boundaries. From a hydrologic standpoint, the distance between the project locations indicates that the impacts for one project are distinct and separate from those of another. One potential exception to this situation is found in the case of the proposed Dolet Hills Lignite Mine Project and the permitted Oxbow Mine.

The Oxbow Mine is located in the topographically flat, Red River alluvial valley, approximately 4 kilometers (2.5 miles) east of the Dolet Hills Project's eastern boundary. At the Oxbow Mine, lignite will be mined from Wilcox Group formations that underlie an average 15.2 to 27.4 meters thickness (50 to 90 foot) of saturated, relatively permeable, alluvial deposits. Dewatering of the alluvial deposits will be conducted within a system of vertical, slurry cutoff walls that extend from ground surface to the base of the alluvium. In addition, the water-bearing formations of the underlying Wilcox formation will be depressurized to prevent water-inflow and pit-stability problems. Dewatering and depressurization at the Dolet Hills Project is planned to be a far less extensive undertaking. The depths of mining involved are generally less and hydrostatic pressures encountered during mining should be notably less than those encountered at the Oxbow Mine.

TABLE 5-26

PRIME FARMLAND IMPACTED BY PRESENT OR PLANNED SURFACE LIGNITE MINES/ASSOCIATED FACILITIES IN THE VICINITY OF THE DOLET HILLS LIGNITE MINE PROJECT

Project[a]	Parish/County	SCS Prime Farmland (acres)[b]	LOCSMD/RRC Historical Use Prime Farmland (acres)
Dolet Hills Mine/Power Plant	DeSoto	7,444	68
Castor Bayou Mine	DeSoto	6,376	46
Oxbow Mine/Power Plant	DeSoto Natchitoches Red River	17,005	NA[c]
Martin Lake Mine D	Rusk	9,367	NA
South Hallsville Mine/ Power Plant	Harrison	6,314	0

a. Chicot Mine/Big Cajun #4 Power Plant is planned for Red River and Bienville parishes but no public information is available.

b. For conversion to metric, see Conversion Table.

c. NA = not available.

The potential exists for the radius of influence of both mines to overlap. One possible outcome of such an overlap would be that ground-water drawdowns in the overlap area would be greater than one would expect by looking at either project separately. Should such an overlap occur, however, it would be possible that the dewatering or depressuring requirements for both mines could be achieved with smaller scale dewatering systems than currently envisioned.

5.9.3 Surface Water

5.9.3.1 Hydrologic Conditions

Cumulative impacts of multiple projects on the hydrologic characteristics of an area (i.e., streamflow conditions, water availability) are possible whenever watersheds or streams common to two or more projects are affected. In such instances, any cumulative impacts are largely dependent upon the proximity of the projects within a watershed, the characteristics of the commonly-affected stream(s) (e.g., drainage area, magnitude of flows, etc.), and the separate impacts of the individual projects on hydrologic conditions.

In the case of the proposed Dolet Hills Lignite Mine and Power Plant Projects and other known projects in the area, major instances of cumulative surface water impacts are not anticipated. As noted previously, the proposed project's mining operations will occur within portions of both the Red and Sabine river basins, and effects on streamflow characteristics (runoff peaks and volumes, low flow characteristics, etc.) will be distributed among a number of streams in both basins. Other existing or announced mine and/or power plant projects in the area, including Martin Lake, South Hallsville/Pirkey, and Castor Bayou in the Sabine River Basin, and Oxbow, Chicot and Big Cajun #3 and #4 in the Red River Basin, can be expected to have similar effects on streamflow characteristics within their immediate areas. However, as such effects are very localized, and the streams commonly affected by the projects (the Sabine and Red rivers) are major rivers, detectable cumulative impacts on streamflows are not anticipated. With regard to water availability, particularly makeup water for the power plants, the effects of multiple diversions from a given stream or reservoir (e.g., the Sabine River or Toledo Bend Reservoir) are considered to be cumulative adverse impacts insofar as any diversion affects downstream water availability.

5.9.3.2 Water Quality

Surface water quality impacts on a given stream segment resulting from multiple point and non-point source discharges are essentially additive within short, localized stream reaches. However, such impacts generally dissipate in the downstream direction as a result of dilution and the assimilative capacity of the receiving stream. As potential cumulative water quality impacts of the proposed Dolet Hills Lignite Mine and Power Plant and other existing or proposed mines and power plants would be limited to major streams (the Red and Sabine rivers), and since discharge locations are distributed over a large geographical area and involve a large number of separate tributaries in both river basins, major cumulative water quality impacts are not anticipated.

5.9.4 Air Quality

Two dispersion modeling studies were performed to determine the cumulative impacts on regional air quality from the proposed Dolet Hills Power Plant, as well as from any existing, new, or proposed (as of 1980) point emission sources in the area (Sargent and Lundy, 1978, 1980). All major point sources (>100 tons per year) for each criteria pollutant within a 50-kilometer (31-mile) radius of the plant location, as well as any major point sources with high emission rates located just outside the impact area but having an effect on it, were considered in the modeling studies. Emissions from the Big Cajun #3 Power Plant/Oxbow Mine were included in the analysis. Emissions from the Martin Lake and Pirkey Power plants in Texas were not included due to their large distances (approximately 100 kilometers; 62.5 miles) from the proposed project area. All pollutant concentrations predicted by the modeling were shown to be well below the National Ambient Air Quality Standards (NAAQS), even when added to the existing regional ambient concentrations reported by the LDNR. Since the proposed Dolet Hills Lignite Mine Project will be primarily a fugitive TSP source, its impact was not included in the analysis, nor were any other existing or proposed lignite projects. In general, the impact of lignite mining operations on local air quality will be small, unless several mines attempt to site immediately adjacent to one another, in which case the ambient TSP air quality could approach unacceptable levels. In this case, the close proximity of the Oxbow Mine is not expected to have an adverse impact on the air quality of the proposed project, due to the rapid fallout of fugitive particles.

Subsequent to the completion of the previously mentioned modeling studies, the Big Cajun #4 Power Plant has been proposed to be sited north of Coushatta. Its emissions will probably have some additional impact on the results of the modeling analyses. The extent of its impact is undetermined at this time since the information pertaining to it is not yet public.

5.9.4.1 Acid Rain

Recent studies have demonstrated the occurrence of increasingly acidic rainfall in the eastern and northeastern United States. In the Texas-Louisiana region, acid precipitation has not been a major issue in the past. However, it is rapidly becoming an issue of significance, as noted in a statewide acid deposition study recently completed for the Texas Energy and Natural Resources Advisory Council (EH&A, 1982a). Recent acid deposition monitoring has indicated the presence of slightly acidic rainfall in east Texas. However, the overall impact on this phenomenon from power plant emissions in general is undetermined at this time.

5.9.4.2 Radioactive Emissions

Cumulative impacts of radioactive emissions from the Dolet Hills Project and the other regional surface lignite mines and power plants are not expected to be significant. Mining operation emissions will impact at points immediately adjacent to the mining area and will decrease rapidly with distance. Power plant emissions (gases and particulate matter emitted at stack-top level) will have a maximum annual impact within five kilometers (3.1 miles) of the stacks. The greatest cumulative impacts from all the sources will be found close-in to the individual sources and will be attributable almost entirely to those individual sources. The increases in the existing radionuclide concentrations resulting from the operation of the individual mines and power plants are expected to be small (as shown previously in the combined impacts section) and will become much smaller with distance.

5.9.5 Ecology

Since adverse impacts of energy projects to vegetation and wildlife are primarily associated with land preemption, the cumulative impacts can be assessed in terms of the total acreages involved. The nine parishes and counties in the vicinity of the proposed Dolet Hills Lignite Mine Project comprise a total of approximately 1,966,524 hectares

(4,933,342 acres), most of which is presently forested. A total of seven planned or operating power plant/mine projects occur in these parishes and counties. Though impacted acreages for two of these energy projects have not been presented publicly, the remaining five projects have or will impact approximately 49,212 hectares (121,600 acres) or 2.5 percent of the acreage within these nine parishes and counties. Due to a lack of available information, this impacted acreage does not include past and ongoing mining operations conducted at Martin Lake. Approximately fifty-four percent of this impacted acreage consists of forested land. This forested acreage consists of approximately 67.6 percent upland pine/hardwood forest, 21.4 percent bottomland hardwood forest, and 11.0 percent managed pine forest. The nonforested acreage is overwhelmingly composed of pastureland with some regeneration/cutover, cropland and hydric and aquatic habitats included.

The most serious cumulative impact upon the vegetation is the postmining conversion of predominantly native, natural vegetation to agricultural land uses (predominantly improved pasture and pine plantations). Therefore, wildlife habitat will be preempted in the long-term. Also, some of the more sensitive habitat types (e.g., marshes, swamps, bogs, etc.) cannot or may not be fully re-established after reclamation. Therefore, these potential, cumulative adverse impacts constitute an irretrievable commitment of these natural resources.

5.9.6 Socioeconomics

Regionally, De Soto, Natchitoches, Red River, and Sabine parishes will be affected by the Dolet Hills Lignite Mine Project and thus in-migration, community infrastructure, transportation, etc. that will also be affected by other mining projects in the four-parish area are considered below.

5.9.6.1 Employment Effect

Based on employment projections made available by the respective development firms, cumulative construction and operations work forces for the Dolet Hills Lignite Mine/Power Plant, Castor Bayou Mine, and Oxbow Mine/Power Plant projects will peak in 1985, when a maximum of 2,858 persons will be directly employed (see Table 5-27). Of this total, 2,196 workers will be engaged in the construction phase of their respective projects. Cumulative operations phase employment reaches a peak in 1987, with 1,049 workers and

TABLE 5-27

CUMULATIVE EMPLOYMENT EFFECTS
LIGNITE MINE/POWER PLANT PROJECTS IN
NORTHWESTERN LOUISIANA 1981-1990

Project	Location	Developer	Number of People Employed									
			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Castor Mine	DeSoto	Dow										
Construction			55	20	19	50	84	183	212	235	116	--
Operations			65	64	65	114	114	114	254	290	286	411
Total			120	84	84	164	198	297	466	525	406	411
Oxbow Mine/Plant	Red River DeSoto Natchitoches	Phillips/Cajun										
Construction			--	550	1,181	1,250	1,250	869	200	--	--	--
Operations			--	--	--	193	311	310	485	447	447	570
Total			--	550	1,181	1,443	1,561	1,179	685	447	447	570
Subtotals												
Construction			55	570	1,200	1,300	1,334	1,052	412	235	116	--
Operations			65	64	65	307	425	424	739	737	733	981
Total			120	634	1,265	1,607	1,759	1,476	1,151	972	849	981
Dolet Hills Mine/ Plant DeSoto	DeSoto	CLECO/SWEPCO										
Construction			--	260	545	862	862	130	--	--	--	--
Operations			--	--	--	25	264	307	310	310	310	310
Total			--	260	545	887	1,126	437	310	310	310	310
Totals												
Construction			55	920	1,745	2,162	2,196	1,182	412	235	116	--
Operations			65	64	65	332	689	731	1,049	1,047	1,043	1,291
Grand Total			120	984	1,810	2,494	2,858	1,913	1,461	1,282	1,159	1,291
Dolet Hills Percent of Total												
Construction (Percent)			0	38.0	31.2	39.9	39.3	11.0	0	0	0	
Operations (Percent)			0	0	0	7.5	38.3	42.0	29.6	29.6	29.7	24.0
Total (Percent)			0	35.6	30.1	35.6	39.4	22.8	21.2	24.2	26.7	24.0

remains at a relatively high level through 1990. In its peak construction year of 1985, the Dolet Hills Lignite Mine/Power Plant Project accounts for nearly 40 percent of total employment for the three projects. Thereafter through 1990, the Dolet Hills operations work force accounts for between 21 and 27 percent of mine/plant employment in the project area.

5.9.6.2 Community Services and Facilities

The in-migrant population associated with the above employment projections will create additional demands upon the service and infrastructure capabilities of communities in the project area. Water and sewage facilities are currently inadequate or in need of improvement in several area communities, and sufficient police, fire protection, and other services are lacking, especially in rural areas. Community services and facilities will be adversely impacted.

5.9.6.3 Transportation

Average daily traffic is expected to increase by at least 10,000 vehicles daily by 1985 as a result of the various industrial projects underway or planned in the four-parish area. An equal number of vehicle trips is likely to result from secondary in-migrating population. Among the roads most heavily affected will be U.S. 171, U.S. 84, LA 1, LA 175, and urban arterials.

5.9.6.4 Recreation

Recreational resources will bear additional demands especially in De Soto Parish, as mine/plant and secondary workers and their families move into the area. In reviewing the recreational needs associated with all major industrial developments in the four-parish area, the Coordinating and Development Council estimated that an additional 159 basketball courts, 26 tennis courts, 5 softball fields, 28 playgrounds, 32 playfields, and 6 swimming pools will be required by 1986 to meet the Louisiana State Parks and Recreation Commission standards (CDC, 1981).

5.9.7 Land Use

The four-parish study area described in Section 5.7, is also used as the study area for discussion of cumulative land-use impacts. Three proposed energy projects will directly or indirectly affect the land use in the De Soto, Natchitoches, Red River and Sabine parishes. Impacts created by another project, Big Cajun #4 Power Plant and the Chicot Mine, cannot be assessed due to unavailable data. Impacts from the remaining projects, the Dolet Hills Lignite Mine and Power Plant, the Castor Bayou Mine, and the Big Cajun Power Plant/Oxbow Mine, are discussed below.

The combined acreage of all three projects will directly impact 2.9 percent of the four-parish area. Two of the three energy projects are located entirely within De Soto Parish. Construction and operations of the Dolet Hills Lignite Mine and Power Plant and the Castor Bayou Mine will directly impact approximately 8 percent of the total land area of De Soto Parish.

With the exception of the Big Cajun #3 Power Plant, land uses within these projects were categorized according to OSM land-use definitions. Over two-thirds (67.9 percent) of the 26,239 hectares (64,835 acres) impacted by these projects are currently forested land. Based upon 1981 production and the value of pine pulpwood and pine sawtimber for De Soto Parish, the removal or disturbance of approximately 17,810 hectares (44,007 acres) of forestland by these projects could result in a loss of $1,584,252 to $12,321,960 per year. The lesser figure assumes 100 percent utilization of forested areas for pulpwood while the higher figure assumes 100 percent utilization for sawtimber (Louisiana Department of Natural Resources, 1982). However, currently only about half of all forested lands in the permit area are commercially forested.

Pastureland and cropland comprise the other two major land uses in the affected project areas. Approximately 4,668 hectares (11,534 acres) or 17.8 percent of all land is currently pastureland. This number includes 1,200 hectares (2,965 acres) of land found in the proposed Big Cajun #3 Power Plant site classified as pastureland/cropland. While different land use categories were used to describe the land use within this site, the majority of the land is currently being used as pasture for grazing (Bovay et al., 1980). Cropland comprises about 10.1 percent (2,648.1 hectares) of the area, consisting mainly of row crops. The remaining 1,112.9 hectares (2,750 acres) of land is divided between grazing land (2.6 percent), water resources (.6 percent), residential (.5 percent), commercial/industrial (.3 percent), and other (0.2 percent), which includes rights-of-way, churches, cemeteries, and wetlands.

Several major oil and gas pipelines and transmission lines will be abandoned, replaced or rerouted because of these projects. Traffic along several roadways will also be directly or indirectly disrupted, with a portion of at least one roadway requiring relocation. The Dolet Hills Lignite Mine and Power Plant and the Castor Bayou Mine will directly or indirectly adversely impact 385 dwelling units. No data was available on dwelling units potentially impacted by the Big Cajun #3/Oxbow Project.

Additional direct adverse impacts to the four-parish study area will be felt by increased urbanization to project-related in-migrating populations. This influx of people could stimulate new commercial facilities, new residential facilities, and associated new utilities installation.

5.9.8 Cultural Resources

Cultural resources are likely to be affected by these energy projects because of the large land areas that are required. However, State and Federal law dictates that impacts on cultural resources be considered in each of these projects. Compliance with these requirements should adequately protect these resources. Cumulatively, an overall beneficial impact may be derived from the expansion of knowledge regarding past cultures through surveys provided with this compliance.

5.10 EFFECTS OF ALTERNATIVES AVAILABLE TO EPA

Alternatives available to EPA in accordance with its regulatory and permitting authority pursuant to Section 402 of Federal Water Pollution Control Act (FWPCA) are to issue or to deny the new source NPDES permit requested by DHMV. If issued, conditional requirements or modifications based on anticipated project impacts may be added to the permit, if warranted.

5.10.1 Issuance of Permit

The issuance of the new source NPDES permit (Appendix A) will allow DHMV to operate the proposed Dolet Hills Lignite Mine as described in Section 4.0. The permit will be modified by certain conditions during the construction and operation of the mine; e.g., an MOA to protect archeological resources. Special conditions may also be added to the permit if projected environmental impacts of the operation of the mine warrant additional monitoring and reporting.

5.10.2 Denial of Permit

EPA could deny the NPDES permit if (1) the mine discharges violate effluent limitations, and/or water quality standards, (2) discharges are found to have a significant adverse impact on the human environment, or (3) if environmental considerations such as endangered species, historic and/or archaeological sites, potential prime farmland, etc. are significantly affected, and measures for mitigating adverse impacts are not proposed or are determined unacceptable. Denial of the permit would likely result in the applicant suspending construction of the project. Should the NPDES permit application be denied by EPA, DHMV would have the options of redesigning proposed pollution control facilities and/or other project plans and resubmitting the application, locating and evaluating another project, or pursuing the no-project alternative.

Since the Dolet Hills Power Plant in proximity to the proposed mine has been permitted and construction begun by SWEPCO, certain environmental effects such as the conversion of approximately 650.8 hectares (1,608 acres) of existing land use (primarily forestland), loss of wildlife habitat, fugitive dust generation, and soil erosion have already occurred as a result of plant site and transportive systems construction activities. If the proposed mine project permit is denied, SWEPCO would have to either alter existing power plant design and pursue more costly fuel alternatives (e.g., western coal), or terminate construction of the power plant. Termination of the power plant project would result in SWEPCO's loss of capital investment in the power plant of approximately $100,000,000 and future benefits derived by the local economy. Estimated loss of capital expenditures incurred by the proposed mine would be approximately $19,500,000. Likewise, future local economic benefits brought about by the proposed mine project during its 32-year life would be lost. If the "no action" alternative is implemented by SWEPCO, demand for electrical power in SWEPCO's service area will have to be met by some other means (e.g., purchased power) which would increase the cost of power to the consumer. Moreover, because much of the proposed mine project area is underlain by lignite, it is expected that resource development would eventually occur, resulting in environmental impacts similar to those associated with the proposed project.

6.0 COORDINATION (INCLUDING EIS MAILING LIST)

6.1 SCOPING PROCESS

On 1 June 1982, EPA issued a Notice of Intent to prepare the SEIS for the Dolet Hills Lignite Mine Project. (Documentation is provided at the end of Section 6.0.) On 6 July 1982 a public scoping meeting was held at the De Soto Parish Instructional Material Center in Mansfield, Louisiana. Approximately 75 persons representing private interests, project representatives and Federal and state agencies attended the meeting. The significant issues identified during the "Scoping Process" by the public and other Federal and State agencies are presented in the Responsiveness Summary (see EPA letter dated 20 August 1982 at the end of Section 6.0).

6.2 FEDERAL AGENCIES

6.2.1 U.S. Army Corps of Engineers

The Dolet Hills Lignite Mine Project permit area falls under the jurisdiction of both the New Orleans and Ft. Worth districts of the USCE. Through mutual agreement, the New Orleans District was delegated the responsibility to determine the boundary of wetlands in the permit area under the jurisdiction of the USCE. On 5 August, the New Orleans District conducted a wetlands determination of the area. Approximately 101.2 hectares (253 acres) of wetlands were found in the southeastern portion of the permit area. The USCE determination and wetlands map are found at the end of Section 6.0.

6.2.2 U.S. Fish and Wildlife Service

On 21 July 1982, EPA requested that FWS provide a list of threatened and endangered species that may occur within the permit area. FWS responded on 3 August 1982 that a Biological Assessment would be required for the Red-cockaded Woodpecker under Section 7(c) of the Threatened and Endangered Species Act of 1973, as amended. A Biological Assessment has been prepared by EPA. As a result of this assessment, EPA determined that there is "no effect" on the Red-cockaded Woodpecker. This determination has been provided to the FWS (Jackson, Mississippi) for their review and biological opinion. Documentation is presented at the end of Section 6.0.

In addition, DHMV met with FWS, Lafayette, Louisiana on 5 August to present its postmining land use and reclamation plans and to request input.

6.3 STATE AGENCIES

6.3.1 Louisiana Office of Conservation, Surface Mining Division

LOCSMD is the regulatory and permitting authority for all surface mining in the State of Louisiana, and was granted this authority by the U.S. Office of Surface Mining, DOI, on October 10, 1980. LOCSMD's authority and responsibility cover virtually all parameters of surface mining, including environmental resources, mining procedures and engineering techniques, and reclamation. It is a requirement of LOCSMD staff to conduct a minimum of one partial inspection per month, and one complete inspection per quarter during the proposed mining operations, plus additional frequent periodic inspections as deemed necessary, to assure full compliance with LOCSMD rules and regulations. The applicant met with LOCSMD regarding the proposed project on several occasions, and submitted the Surface Mining Application on October 13, 1982.

6.3.2 Louisiana Department of Transportation and Development

In the course of mining, LA 522 may need to be relocated, the conveyor system will extend across LA 175 during mining operations in the southwest portion of the permit area, and two draglines will be moved across LA 175 twice. In anticipation of these activities, DHMV met with the Department of Transportation and Development on 10 August 1982. Because all activities involving state roadways are planned around the late 1990's-2017, the Department determined that no formal action was necessary at this time; however, DHMV should contact LDTD prior to commencement of these activities.

6.4 LIST OF AGENCIES, ORGANIZATIONS AND PERSONS TO WHOM COPIES OF THE DRAFT STATEMENT ARE SENT

Louisiana Department of Natural Resources, Baton Rouge, LA
Louisiana Division of Nuclear Engineering, Baton Rouge, LA
Clean Air and Water, Inc., Beaumont, TX
Louisiana Office of Aviation and Public Transportation, Baton Rouge, LA
Louisiana Office of Highways, Baton Rouge, LA

Louisiana Office of Public Works, Baton Rouge, LA
Louisiana Office of Planning and Technical Assistance, Baton Rouge, LA
Louisiana Office of State Clearinghouse, Baton Rouge, LA
Louisiana Department of Wildlife and Fish, New Orleans, LA
Texas Water Resources Institute, College Station, TX
Assistant Attorney General, New Orleans, LA
Louisiana Office of Conservation, Baton Rouge, LA
Louisiana Public Service Commission, Baton Rouge, LA
Louisiana Wildlife Federation, Baton Rouge, LA
Audubon Society, Brownwood, TX
Louisiana Environmental Protection Association, Metairie, LA
American Lung Association of Louisiana, New Orleans, LA
Assistant Attorney General, Baton Rouge, LA
Eighth Coast Guard District, New Orleans, LA
U.S. Army Corps of Engineers, Fort Worth, TX
National Wildlife Federation, Norman, OK
Louisiana Division of State Lands, Baton Rouge, LA
U.S. Fish and Wildlife Service, Jackson, MS
U.S. Geological Survey, Austin, TX
Arkansas Highway and Transportation Department, Little Rock, AR
U.S. Department of Agriculture, Washington, DC
Louisiana Department of Culture, Recreation, & Tourism, Baton Rouge, LA
NOAA/U.S. Department of Commerce, Washington, DC
Louisiana Department of Justice, Baton Rouge, LA
FmHA, Alexandria, LA
Louisiana ACORN, New Orleans, LA
HUD Area Office, New Orleans, LA
New Orleans District - COE, New Orleans, LA
Honorable W. Henson Moore, U.S. House of Representatives, Washington, DC
Honorable J. B. Johnston, U.S. Senate, Washington, DC
U.S. Forest Service, Atlanta, GA
Louisiana Geological Survey, Baton Rouge, LA
Vicksburg District - COE, Vicksburg, MS
Louisiana League of Women Voters, Baton Rouge, LA
U.S. Fish and Wildlife Service, Vicksburg, MS
Broadhurst, Brook, Miller and Reed, Lafayette, LA

Louisiana Wildlife and Fish Commission, Baton Rouge, LA
Rapides Wildlife Association, Pineville, LA
U.S. Fish and Wildlife Service, Atlanta, GA
The Ozark Society, Inc., Springfield, MO
Staff Assistant for Honorable Russell B. Long, Baton Rouge, LA
Legislative Correspondent for Honorable Russell B. Long, Washington, DC
U.S. Fish and Wildlife Service, Atlanta, GA
Soil Conservation Service, Alexandria, LA
Governor of Louisiana, Baton Rouge, LA
Louisiana Department of Agriculture, Baton Rouge, LA
Louisiana Office of State Parks, Baton Rouge, LA
Sierra Club, Baton Rouge, LA
Louisiana Soil and Water Conservation Commission, Baton Rouge, LA
James E. Hoelscher, Jr., Fayettville, AR
Louisiana Office of Tourism, Baton Rouge, LA
Director-Land Resources Continental Forest Ind., Stamford, CT
Wildlife Management Institute, Dripping Springs, TX
Louisiana Governor's Office Science, Technical, and Environment Policy, Baton Rouge, LA
Horace J. Thibodaux, Houma, LA
Louisiana Health and Human Resources, New Orleans, LA
Louisiana Office of Mineral Resources, Baton Rouge, LA
Louisiana Office of Forestry, Baton Rouge, LA
Southwest Federal Regulation Council, Dallas, TX
Department of Health and Human Service, Dallas, TX
Federal Energy Regulation Commission, Fort Worth, TX
Izaak Walton League, Albuquerque, NM
Arkansas Department of Pollution Control and Ecology, Little Rock, AR
Southern Company Service, Inc., Birmingham, AL
Office of Surface Mining, Denver, CO
EPA Region VIII, Denver, CO
American Association of University Women, Alpine, TX
Federal Emergency Management Agency, Denton, TX
U.S. Forest Service, Albuquerque, NM
Sierra Club, Dallas, TX
Department of Health and Human Services, Dallas, TX
U.S. Department of Energy, Dallas, TX

Department of Health and Human Services, Atlanta, GA
EPA Region I, Boston, MA
EPA, Region III, Philadelphia, PA
American Wilderness Alliance, Denver, CO
U.S. Department of Energy, Washington, DC
EPA, Region IV, Atlanta, GA
EPA, Region VII, Kansas City, MO
EPA Region IX, San Francisco, CA
New Mexico Department of Agriculture, Las Cruces, NM
Department of Interior, Albuquerque, NM
Office of Surface Mining, Denver, CO
U.S. Bureau of Mines, Denver, CO
U.S. Department of Interior, Washington, DC
U.S. Department of Housing and Urban Development, Fort Worth, TX
Federal Aviation Administration, Fort Worth, TX
National Park Service, Albuquerque, NM
Department of Transportation, Washington, DC
National Park Service, Santa Fe, NM
Agriculture Stab. and Conservation Service, Washington, DC
Brown and Root, Houston, TX
Colorado State University, Fort Collins, CO
Environmental Law Institute, Washington, DC
Arkansas State Highway and Transportation Department, Little Rock, AR
Environmental Defense Fund, Washington, DC
Federal Highway Administration, Fort Worth, TX
National Wildlife Federation, Washington, DC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

June 1, 1982

NOTICE OF INTENT
to prepare a
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

AGENCY: U.S. Environmental Protection Agency (EPA)

ACTION: Notice of Intent to prepare a Supplemental Environmental Impact Statement (SEIS) on the proposed Dolet Hills Surface Lignite Mine near Mansfield, Louisiana, pursuant to 40 CFR 1501.7.

PURPOSE: To fulfill the requirements of Section 102(2)(c) of the National Environmental Policy Act (PL 91-190).

On June 2, 1981, EPA issued a Notice of Intent to prepare an EIS on the Dolet Hills Power Plant. EPA's decision requiring this EIS included the stipulation that a NPDES permit decision on the adjacent lignite mine would be "tiered" as a second stage (ref. 40 CFR 1502.20(b)), since information was not available for the Agency to focus on mining issues.

Southwestern Electric Power Company (SWEPCO) and Central Louisiana Electric Company, Inc. (CLECO) have announced the signing of the lignite mining contractor for supplying the fuel to the Dolet Hills Power Plant from the adjacent lignite holdings. A completed mine plan for use in preparing the Supplemental Draft EIS should be available in June, 1982. Consequently, the information now will exist to adequately prepare an EIS for the proposed lignite mining project.

This Supplemental EIS will be prepared by Espey, Huston & Associates, the Third Party Contractor, and the Statement is intended to fulfill, to the extent possible, the NEPA requirements associated with Section 404 permit(s) under the Clean Water Act, and other Federal laws and regulations which may require the preparation of an EIS.

FOR FURTHER INFORMATION CONTACT:

Mr. Clinton B. Spotts
Regional EIS Coordinator
U.S. EPA, Region 6 (ES-FP)
1201 Elm Street
Dallas, Texas 75270

Telephone: 214-767-2716
FTS-729-2716

SUMMARY:

1. Description of Proposed Project. The selected mine contractor is a joint venture partnership composed of Costain Holdings, Inc., Costain Australia, Ltd. and J. A. Jones Construction Company. The joint partnership will be referred to as the Dolet Hills Mining Venture. Start of construction on the mine is scheduled for mid-1983, while the mining operation will begin in the fall of 1985. The proposed mining and reclamation procedures consist of land clearing, over-burden removal, lignite removal, transportation of the lignite to the power plant site via conveyor belt system, and land reclamation and revegetation. Initial mine production will be about 2.5 million tons per year for the first unit at the Dolet Hills power plant. Ultimately, the mine will produce about 5 million tons annually to fuel two power plant units. The mine, covering about 20,000 acres, is expected to be operational for about 25 years. Approximately 300 acres of leased land will be mined and reclaimed yearly for each unit in operation, with an average annual overburden removal of 28 million cubic yards. The overburden will be removed initially by dragline with additional draglines and a bucket wheel excavator to be utilized later in the life of the mine. The mining operation is predicted to create some 240 jobs with an estimated annual payroll of $7.5 million.

2. Alternatives.

First Stage - EPA's preferred alternative for the Dolet Hills Power Plant Project, as documented in the Final EIS, is to issue a NPDES permit with a condition requiring SWEPCO and CLECO to follow a Memorandum of Agreement which outlines specific procedures for compliance with Section 106 of the National Historic Preservation Act. EPA's final decision on the NPDES permit for the proposed Dolet Hills Power Plant is pending.

Second Stage - A. EPA issues NPDES permit for lignite mine.
   (1) SWEPCO & CLECO operate mine as proposed.
   (2) SWEPCO & CLECO operate mine with conditions.

B. EPA denies NPDES permit for lignite mine.
   (1) SWEPCO & CLECO modify mine operations, requiring not EPA permit.
   (2) SWEPCO & CLECO take no action.

3. Public and Private Participation in EIS Process. The issues and concerns identified during the Scoping Process will help determine the extent of impact analyses for the SEIS. EPA invites and encourages full participation in the SEIS process by individuals, private organizations, and local, State and Federal Agencies.

4. Scoping. EPA, Region 6, has initiated the Scoping Process and will conduct a public meeting for the purpose of identifying issues for consideration in the preparation of the Supplemental Draft EIS on the proposed lignite mine. This "Scoping Meeting" will be held at 7:30 p.m. on July 6,1982 at the De Soto Parish Instructional Material Center, located on Oxford Road in Mansfield, Louisiana.

5. Timing. EPA estimates the Supplemental Draft EIS on the Dolet Hills lignite mine will be available for public review and comment in November, 1982. Time requirements have been estimated for the "second stage" environmental review at the following milestones:

Developing Scope of SEIS -	August, 1982
Availability of SEIS -	November, 1982
Record of Decision on "Second Stage" -	July, 1983

6. Copies of SEIS. For a copy of the Supplemental Draft EIS, please submit your name and mailing address to Mr. Clinton B. Spotts at the above address.

Frances E. Phillips

f Dick Whittington, P.E.
Regional Administrator

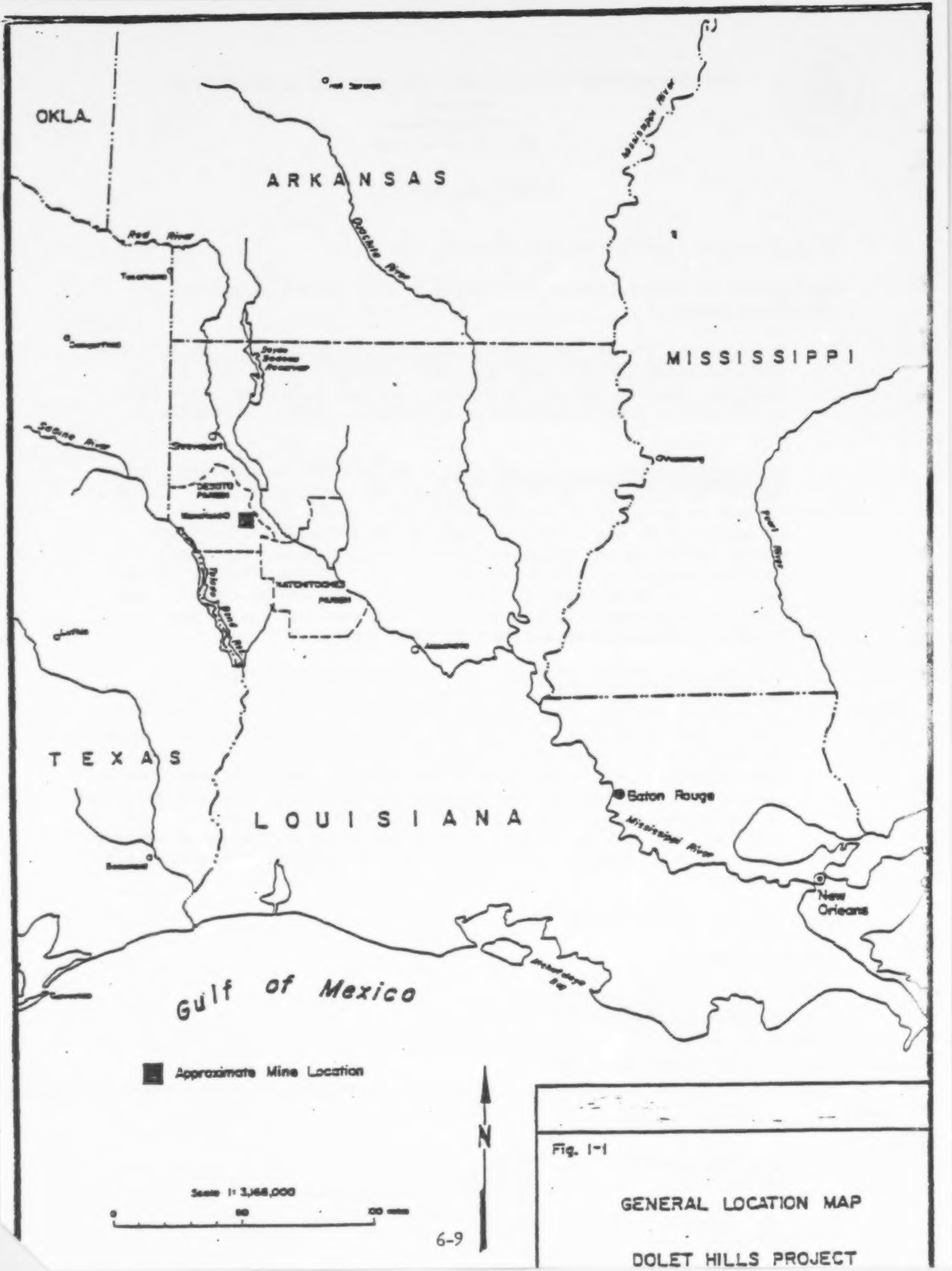

OKLA.
ARKANSAS
MISSISSIPPI
TEXAS
LOUISIANA
Red River
Ouachita River
Mississippi River
Sabine River
Pearl River
Texarkana
Shreveport
DESOTO PARISH
Mansfield
NATCHITOCHES PARISH
Toledo Bend Res.
Lufkin
Alexandria
Vicksburg
Baton Rouge
Mississippi River
New Orleans
Gulf of Mexico
Approximate Mine Location
N
Scale 1: 3,168,000
0
50
100 miles

Fig. 1-1

GENERAL LOCATION MAP

DOLET HILLS PROJECT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

August 20, 1982

TO DOLET HILLS LIGNITE MINE EIS MAILING LIST:

The purpose of this letter is to provide a brief update of current and future events:

1. The Availability of the Scoping Meeting Responsiveness Summary - The Responsiveness Summary (copy enclosed) presents EPA's response to comments received during the scoping process as well as those made at the public scoping meeting held on July 6, 1982, in Mansfield, LA.

2. Information Depository Established - An Information depository has been established at the DeSoto Parish Instructional Material Center, located on Oxford Road in Mansfield, LA. An EIS project file will be updated with the latest information regarding EPA's environmental review on the proposed lignite mine. The Instructional Material Center is open from 8:00 a.m. to 4:30 p.m., Monday through Friday. Copies of material from this EPA file can be made for the costs of xeroxing. Please contact Mr. Steward Collins at the Material Center for access to this EPA file.

3. Distribution of the Draft EIS - In addition to the Federal and State agencies that will receive and review the EIS, many groups and individuals have demonstrated interest in this project and have been placed on the EIS mailing list. However, we believe that some of these may not still want a copy of the EIS, or may be satisfied with receiving and reviewing only the summary instead of the complete document. Therefore, in the interest of conserving time and resources in the printing and distribution of the Draft EIS, please provide your name and mailing address (see below) to me at the above address if you wish to receive a copy of either the summary or the complete document.

Thank you for your cooperation.

Sincerely yours,

Clinton B. Spotts

Clinton B. Spotts
Regional EIS Coordinator (6ES-F)

6ES-F Please send a copy of:

____only the summary of the EIS to:	Name:______________
	Address:______________
	City:______________
____the complete Draft EIS to:	State:__________ Zip:________

Responsiveness Summary
to the Public Scoping Meeting
on the Dolet Hills Lignite Mine EIS

The U.S. Environmental Protection Agency (EPA) held a public meeting at 7:30 p.m. on July 6, 1982, at the DeSoto Parish Instructional Material Center in Mansfield, Louisiana. The public was invited to identify significant issues which they believed should be addressed and evaluated in the Environmental Impact Statement (EIS).

The significant issues identified during the "Scoping Process" by the public and other Federal and State agencies are as follows:

Reclamation and Revegetation Plans- a discussion of reclamation techniques and supporting evidence for successful revegetation, along with the yearly progression of the mining operation. Also, steps to be taken to insure prime farmland will be returned to its former productive state.

Groundwater and Surface Water- an analysis of likely impacts from operation requirements and disposal of water, as well as monitoring plans and mitigation measures. Also a discussion of steps that will be taken to control and mitigate erosion, increased runoff, and impact to the 100 year floodplain during and after mining operation.

Land Use- a discussion of the impacts resulting from land requirements and changes in land use, such as economic impacts of the changing of forest land to pasture land, or entry on Federal lands or rights-of-way. Also, an evaluation of impacts on important farmland, including prime, unique and farmland of statewide or local importance.

Fish and Wildlife Resources- an analysis of probable impacts and a discussion of how habitat loss will be mitigated. Also, identification and quantification of wetlands to be affected.

Cultural Resources- a discussion of cultural resource surveys and plans to protect sites or mitigate potential impacts.

Socioeconomics- an analysis of mine impacts on housing service demands, and discussion of how the land will be returned to the landowner.

July 22, 1982

Mr. Charles Decker
Chief, Regulatory Functions Branch
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160

Dear Mr. Decker:

On June 1, 1982, EPA issued the enclosed Notice of Intent to prepare a Supplemental Environmental Impact Statement on the proposed Dolet Hills Lignite Mine near Mansfield, Louisiana.

As a part of the environmental assessment necessary for this document, we request that the New Orleans District conduct a survey of the proposed lignite mine and make a determination of the nature and extent of wetlands subject to Section 404 regulations.

For additional coordination, or for any questions on this request, please contact me or Joe Swick at FTS-729-2716.

Sincerely yours,

Clinton B. Spotts
Regional EIS Coordinator (6ES-F)

Enclosure

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

LMNOD-SA

19 August 1982

Mr. Clinton B. Spotts
Environmental Protection Agency
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Spotts:

Reference is made to your request of 22 July 1982 for a jurisdictional determination for acreage included within the Dolete Hills proposed lignite surface mine site in T. 11, 12, 13 N., and R. 10, 11, 12, 13 W., southeast of Mansfield in DeSoto Parish, Louisiana.

As the inclosed memo indicates all of the area except for the three small acreages shaded red on the attached map are not subject to US Army Corps of Engineers' jurisdiction under Section 404 of the Clean Water Act. The three areas shaded red are subject to Corps' jurisdiction. Geographical relief in the proposed mine site is pronounced. The areas under Corps jurisdiction are clearly defined by surface coutours.

This jurisdictional determination was made with coordination between the New Orleans and Fort Worth Corps Districts. An agreement was reached that as most of the acreage lies in the New Orleans District, they would make the determination for their area as well as for the smaller portion of the project site that lies in the Fort Worth District. This determination covers all of the mine project site and represents the coordinated determination of the New Orleans and Fort Worth Districts and the EPA.

Should you have any further questions concerning this determination you may contact Dr. Thom Davidson at (504) 838-2265.

Sincerely,

1 Incl
As stated

C. W. DECKER
Chief, Regulatory Functions Branch
Operations Division

See page 2 for copy furnished.

LMNOD-SA 19 August 1982
Mr. Clinton B. Spotts

Copy Furnished:
US Army Engineers District, Fort Worth
ATTN: SWSOD-C, Ms. Vickie Goodknight
P.O. Box 17300
Fort Worth, TX 76102

✓Mr. Jay Pruett
Southwestern Electric Power Company
P.O. Box 21106
Shreveport, LA 71156

Ms. Minnie Rojo
Environmental Protection Agency
1201 Elm Street
Dallas, TX 75270

MEMO TO FILE

DATE: 9 August 1982

SUBJECT: Wetland Determination - DeSoto Parish

LOCATION: The Dolete Hills Lignite Surface Mine Project includes approximately 30,000 acres in T. 11, 12, 13, N., R. 10, 11, 12, 13 W., just southeast of Mansfield in DeSoto Parish, Louisiana (see attached map).

An onsite inspection was made by helicopter of the 30,000 acre proposed lignite mine site on 5 August 1982. The writer was accompanied by Ms. Minnie Rojo of the EPA.

Almost all of the vast acreage of this proposed mine site is dominated by the following species:

- Loblolly pine
- Southern red oak
- Blackjack oak
- Sweet gum

All of the area dominated by these species is determined not to fall under US Army Corps of Engineers' jurisdiction under Section 404 of the Clean Water Act.

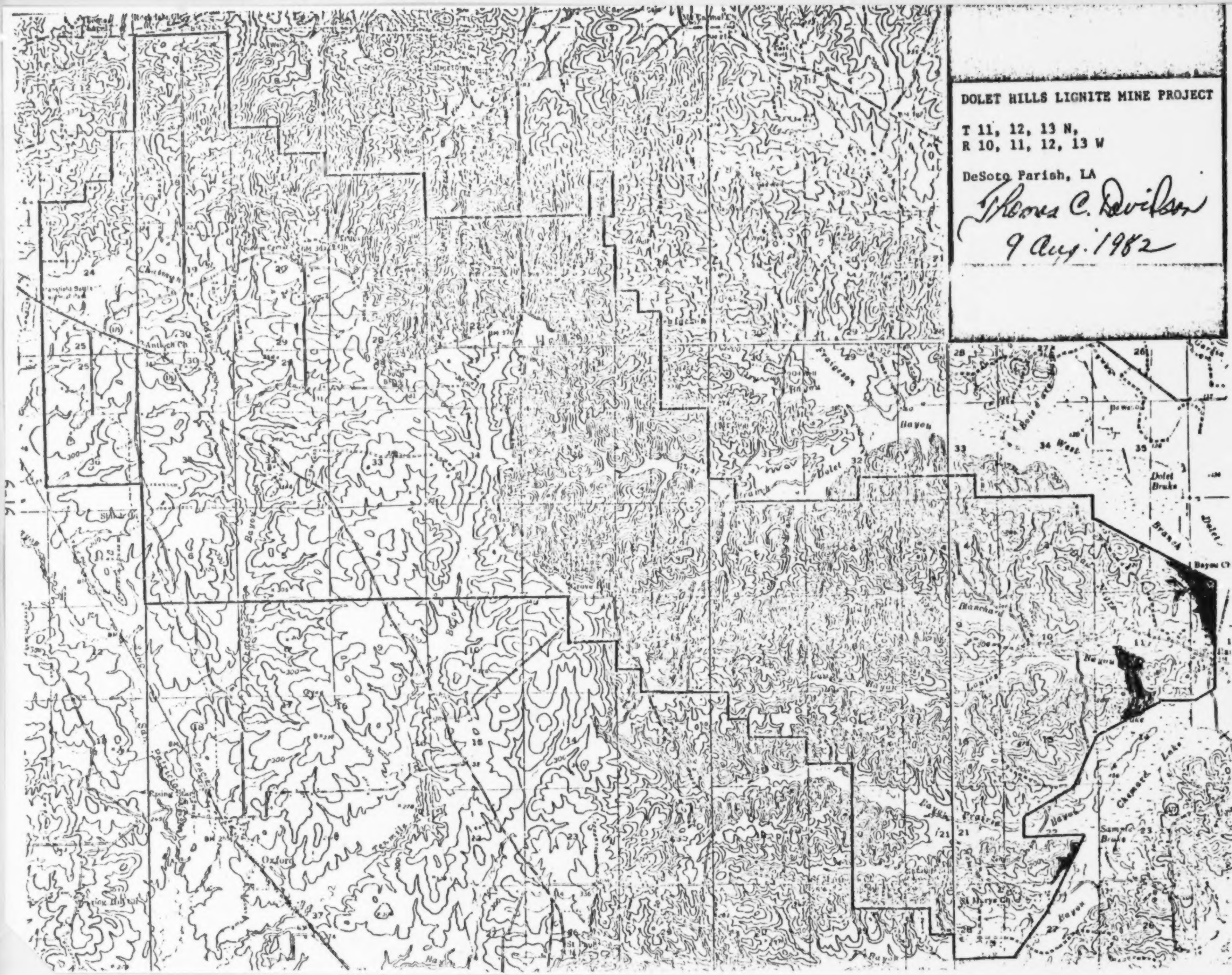
The three areas indicated in red on the attached map were found to be dominated by the following species:

- Bald cypress
- Overcup oak
- Sweet gum
- Buttonbush

The areas indicated in red are subject to Corps' jurisdiction under Section 404 of the Clean Water Act.

Thom Davidson

THOM DAVIDSON, Ph.D.
Botanist
Regulatory Assessment Section


Dolet
Bayou
Dolet Brake
Branch
Grove Hill
Antioch Ch.
Oxford
Prairie
Sample Brake
St Marys Ch.
Frazier
34 West
300

DOLET HILLS LIGNITE MINE PROJECT

T 11, 12, 13 N,
R 10, 11, 12, 13 W

DeSoto Parish, LA

Thomas C. Davidson
9 Aug. 1982

July 21, 1982

Mr. Gary L. Hickman
Area Manager
U.S. Fish and Wildlife Service
Jackson Mall Office Ctr., Suite 3185
300 Woodrow Wilson Avenue
Jackson, MS 39213

Dear Mr. Hickman:

EPA, Region 6, is in the process of preparing a Supplemental Environmental Impact Statement prior to a decision on a New Source NPDES permit for the proposed Dolet Hills Lignite mine. A copy of the Notice of Intent on this EPA action is enclosed for your information.

As a part of this environmental review, we intend to provide appropriate coordination of possible effects on endangered species. To begin coordination, we request that you prepare and send us a list of endangered species applicable to Section 7 consultation for this project.

If you have any questions and/or future coordination, please contact me or Joe Swick at (FTS) 729-2716.

Sincerely yours,

Clinton B. Spotts
Regional EIS Coordinator (6ES-F)

Enclosure

United States Department of the Interior
FISH AND WILDLIFE SERVICE
JACKSON MALL OFFICE CENTER
300 WOODROW WILSON AVENUE, SUITE 3185
JACKSON, MISSISSIPPI 39213

August 3, 1982

IN REPLY REFER TO:
Log no. 4-3-81-157

Mr. Clinton B. Spotts
Environmental Protection Agency
Region IV
1201 Elm Street
Dallas, Texas 75270

Dear Mr. Spotts:

This refers to your letter of July 21, 1982, requesting a list of threatened and endangered species occurring in the vicinity of the proposed Dolet Hills Lignite Mine, DeSoto Parish, Louisiana. As we mentioned in our letter of July 13, 1981, the endangered red-cockaded woodpecker (*Picoides borealis*) may occur in the project area. Unfortunately, we have no site-specific information on colony locations in that vicinity. Our records indicate no other endangered, threatened or proposed species in the area.

As stated in our previous correspondence, since this project requires the preparation of an EIS, Section 7(c) of the Endangered Species Act as amended requires the preparation of a Biological Assessment addressing project impacts to listed species, in this case, the red-cockaded woodpecker. We understand the EIS will be prepared by Espy Houston and Associates. We commend this choice of contractor, since this firm prepared an excellent evaluation of the power plant site relative to the red-cockaded woodpecker.

You should be aware that Commonwealth Associates, Inc., Jackson, Michigan, is working with Cajun Electric Cooperative regarding the routing alternatives for the Dolet Hills power plant transmission lines. You may wish to contact Mr. John M. Bridges of this firm, telephone 517/788-3000, in this regard.

We look forward to working with you on this project. If we can be of further assistance, please contact our office, FTS telephone 490-4900.

We appreciate your concern for endangered species.

Sincerely yours,

Dennis B. Jordan

Dennis B. Jordan
Supervisor
Jackson Endangered Species Office

cc: D, FWS, Washington, D.C. (AFA/OES)
RD, FWS, Atlanta, GA (ARD-FA/SE)
ES, FWS, Lafayette, LA
Department of Wildlife & Fisheries, New Orleans, LA
Espy Houston and Associates
P.O. Box 519, Austin, Texas 78767

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

January 10, 1983

Mr. Dennis B. Jordan
Jackson Endangered Species Office
U.S. Fish & Wildlife Service
300 Woodrow Wilson Ave.
Suite 3185
Jackson, Mississippi 39213

Dear Mr. Jordan:

In July of 1982, we requested a list of threatened and endangered species that may occur in the vicinity of the proposed Dolet Hills Lignite Mine Project near Mansfield, De Soto Parish, Louisiana. On August 3, 1982, the Endangered Species Office in Jackson, Mississippi forwarded a species list to us which contained the red-cockaded woodpecker (Picoides borealis).

A biological assessment has been prepared to address project impacts to this listed species as your letter requested. Based on this assessment, EPA, Region 6, has determined that there will be no effect on the red-cockaded woodpecker as a result of the construction and operation of the proposed Dolet Hills Lignite Mine Project because of the apparent lack of populations or individuals of the species within the permit area.

The completed biological assessment is intended to fulfill the endangered species requirements for EPA's actions and for other Federal actions, to the extent possible. A copy of the biological assessment is enclosed for your information, and copies will be provided to the U.S. Army Corps of Engineers for possible use at their discretion on Section 404 permit actions/environmental reviews.

We appreciate the assistance that your office provided in coordinating the preparation of the subject report. If you have any questions or comments or need additional information on our "no effect" determination, please write me at the above address or contact Joe Swick at FTS 729-2716.

Sincerely,

Norm Thomas for
Clinton B. Spotts
Regional EIS Coordinator (6ES-F)

cc: Dr. Thom Davidson, New Orleans Dist. COE
Ms. Vicki Goodnight, Fort Worth Dist. COE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

May 27, 1981

Mr. Jay A. Pruett
Manager of Environmental Affairs
Southwestern Electric Power Company
P. O. Box 21106
Shreveport, Louisiana 71156

Dear Mr. Pruett:

The information which you submitted on April 23, 1981, regarding the proposed Dolet Hills surface lignite mine to be located in DeSoto Parish, Louisiana, has been reviewed. The purpose of this letter is to inform you of the applicability of Prevention of Significant Deterioration (PSD) regulations to your proposed facility.

Regulations concerning PSD do not apply to the facility you are proposing since all emissions are fugitive, and your facility does not belong to any of the 28 source categories listed at 40 CFR 52.21 (b)(1)(i), or to any other stationary source category which, as of August 7, 1980, is being regulated under Section 111 (New Source Performance Standards) or 112 (National Emission Standards for Hazardous Air Pollutants) of the Clean Air Act.

If you have any questions concerning this matter, please call Mr. Tom Diggs at (214) 767-1594.

Sincerely,

William H. Taylor, Jr.
for Jack S. Divita, Chief
Air Programs Branch

cc: Mr. Gus Von Bodungen
Program Administrator
Louisiana Air Quality Division

7.0 LIST OF PREPARERS FOR THE DOLET HILLS LIGNITE PROJECT ENVIRONMENTAL IMPACT STATEMENT

This environmental impact statement was prepared by Espey, Huston & Associates, Inc. (EH&A) for the U.S. Environmental Protection Agency, Region 6 under the guidance of the EPA Project Officer, Mr. Clinton Spotts, and the Project Monitor, Mr. Norman Thomas. Key personnel from EH&A include:

Topic	Principal Reporter	Title
Project Consultant	George L. Vaught M.S. Biology	Associate
Project Manager	Helen C. Besse B.A. Zoology	Staff Ecologist
Assistant Project Manager	Eugene Woodall B.A. English	Environmental Technician
Editor	Pat Wilkins B.S. Fine Arts	Environmental Technician
Geology, Ground Water	Gilbert Ward B.S. Geology	Staff Hydrogeologist
Soils	James A. DeMent Ph.D. Soils/Geology	Senior Staff Soils Scientist
Surface Water Hydrology	Gary M. Pettit M.S. Engineering Water Resources	Senior Staff Engineer
Climatology/Air Quality	Steve Haggard B. Eng. Science M.S. Meteorology	Staff Meteorologist
	Carl Christiansen M.S. Environmental Engineering	Staff Air Quality Scientist
Sound	Arthur V. Bedrosian B.S. Physics	Senior Staff Meteorologist
	Ron Boyd B.S. Meteorology	Staff Meteorologist
Vegetation	Thomas D. Hayes M. For. Sci. Botany and Systems Ecology	Staff Ecologist
Wildlife	Bruce G. Stewart M.S. Biology	Staff Ecologist
Aquatic	Paul Price B.A. Zoology	Senior Staff Ecologist

Topic	Principal Reporter	Title
Archaeology	Clell L. Bond M.A. Anthropology	Senior Staff Archaeologist
	Melissa Voellinger B.A. Anthropology	Environmental Technician
Socioeconomics	Ellen Cross M.S. Urban & Regional Planning	Staff Socioeconomist
	Tom Van Zandt M.S.C. Water Resource Management, L.D.	Staff Socioeconomist
Land Use	Nora Mullarkey B.A. Sociology	Staff Socioeconomist

8.0 BIBLIOGRAPHY

Alexander, G. B. 1976. Performance report, northeast Texas game management survey. Texas Parks and Wildlife Dept., Austin.

Allaire, P. N. 1979. Coal mining reclamation in Appalachia: low cost recommendations to improve bird/wildlife habitat. In: The Mitigation Symposium: a National Workshop on Mitigating Losses of Fish and Wildlife Habitats (G. A. Swanson, Technical Coordinator). U.S. Department of Agriculture - Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-65. pp. 245-251.

Allison, J. F. 1981. Historical land use survey, Dolet Hills lignite project. Dolet Hills Lignite Mine Project, Mansfield, Louisiana.

_____. 1982. Personal communication to Bruce G. Stewart. Forestry/Land Use Consultant to SWEPCO/CLECO.

Aubert, H. and M. Pinta. 1977. Trace elements in soils. Elsevier Scientific Publishing Co., New York. 395 pp.

Barclay, J. S. 1980. Impact of stream alterations on riparian communities in south central Oklahoma. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-80/17. 91 pp.

Beck, H., C. Gogolak, K. Miller, and W. Lowder. 1980. Perturbations on the natural radiation environment due to the utilization of coal as an energy source. In: The Natural Radiation Environment III. U.S. Department of Energy/Technical Information Center.

Bovay Engineers, Inc., Burns and Roe, Inc., and Espey, Huston & Associates, Inc. 1980. Combined environmental effects report, Big Cajun No. 3 - Bayou Pierre Site and Oxbow Lignite Mine.

Braun, E. L. 1950. Deciduous forest of eastern North America. Blakiston, Philadelphia, Penn.

Brewer, R. 1958. Breeding bird populations of strip-mined land in Perry County, Illinois. Ecology 39:543-545.

Brown, M. 1981. Personal communication. City of Natchitoches, building inspector.

Busnel, R. 1978. Introduction. In: Effects of Noise on Wildlife. J. L. Fletcher and R. G. Busnel (eds.). Academic Press, New York. p. 7-22.

Camp, F. A. 1982. Personal communication. Senior Project Manager, TERA Corp., Dallas, Texas. 19 July.

Cantle, P. C. 1978. Avian population densities and species diversity on reclaimed strip-mined land in east-central Texas. M.S. Thesis. Texas A&M Univ., College Station. 131 pp.

Chow, V. T. 1964. Handbook of applied hydrology. McGraw-Hill Book Co., New York.

Coordinating and Development Corporation. 1982. Public facilities inventory and needs analysis.

_____. 1981. Preliminary housing analyses for the north-western Louisiana lignite area impacted.

Council on Environmental Quality. 1978. Environmental quality - the ninth annual report on the Council of Environmental Quality. U.S. Government Printing Office. Washington, D.C.

Darnell, R. M., W. E. Pequegnat, B. M. James, F. J. Benson, and R. A. Defenbaugh. 1976. Impacts of construction activities in wetlands of the United States. U.S. Environmental Protection Agency, Office of Research and Development. Corvallis, Oregon.

Dempster, J. P. 1975. Animal population ecology. Academic Press, London. 155 pp.

Denver Research Institute. 1979. Socioeconomic impacts of western energy development.

Dice, L. R. 1943. The biotic provinces of North America. University of Michigan Press, Ann Arbor.

Dickson, J. G. 1978. Forest bird communities of the bottomland hardwoods. In: Proceedings of the Workshop, Management of Southern Forests for Nongame Birds (R.M. DeGraaf, Technical Coordinator). U.S. Dept. of Agriculture - Forest Service, Southeastern Forest Experiment Station. Asheville, North Carolina. 176 pp.

Dickson, J. G., R. N. Conner, and J. H. Williamson. 1980. Relative abundance of breeding birds in forest stands in the southeast. Southern Journal of Applied Forestry, 4(4):174-179.

Dickson, J. G. and C. A. Segelquist. 1979. Breeding bird populations in pine and pine-hardwood forests in Texas. Journal of Wildlife Management, 43(2):549-555.

Divita, J. S. 1981. Letter, dated 27 May 1981, to Jay A. Pruett, Manager Environmental Affairs, SWEPCO from Air Programs Branch, EPA, Region 6, Dallas, Texas.

Douglas, N. H. 1974. Freshwater fishes of Louisiana. Claitors Publishing Division, Baton Rouge, Louisiana.

Espey, Huston & Associates, Inc. 1980a. Geologic and hydrogeologic baseline report, Dolet Hills lignite project. EH&A Doc. No. 80239.

_____. 1980b. Soils of the Dolet Hills lignite project. EH&A Doc. No. 80334.

_____. 1980c. Baseline ecology report, Dolet Hills project. EH&A Doc. No. 80293.

_____. 1980d. Big Cajun No. 3 - Bayou Pierre site and Oxbow Lignite mine. Combined Environmental Effects Report. EH&A Doc. No. 79230.

_____. 1981a. Surface water hydrology of the Dolet Hills project. EH&A Doc. No. 79146.

_____. 1981b. Baseline climatology and air quality: Dolet Hills project. EH&A Doc. No. 80119.

_____. 1981c. Dolet Hills Project, socioeconomic baseline. EH&A Doc. No. 8054.

_____. 1982a. Acid deposition in Texas: technical summary and perspective. EH&A Doc. No. 81305. Austin, Texas.

_____. 1982b. Dolet Hills Power Plant: An archaeological survey of a proposed railroad spur corridor and alternate State Route 510 right-of-way, De Soto and Red River parishes, Louisiana. EH&A Doc. No. 82060.

Federal Radiation Council. 1960. Background material for the development of radiation protection standards. Report No. 1. Washington, D.C.

Foster, B.. 1975. Statistics of public elementary and secondary day schools. National Center for Educational Statistics.

Fresquez, P. R. and W. C. Lindemann. 1982. Soil and rhizosphere microorganisms in amended coal mine spoils. Soil Science Soc. AM. Journal. 46: 751-755.

Funk, J. L., and J. W. Robinson. 1974. Changes in the channel of the Lower Missouri River and effects on fish and wildlife. Missouri Department of Conservation, Aquatic Series No. 11.

Golden, J., R. P. Ouellette, S. Saari, and P. N. Cheremisinoff. 1980. Environmental impact data book. Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan.

Grandt, Alten F. 1982. Prime farmland- is restoration reality? Mining Congress Journal, September 1982.

Gray, M. H., and D. H. Arner. 1977. A study of the effects of channelization on furbearers and furbearer habitat. Paper presented at the Thirty-first Annual Conference, Southeastern Association of Game and Fish Commissioners, San Antonio, Texas. October 9-12, 1977.

Gregory, H. F. 1973. Eighteenth Century Caddoan Archeology: A study in models and interpretation. Unpublished doctoral dissertation, Southern Methodist University.

Harbert, H. P. and R. Draves. 1982. Summary of Dolet Hills reclamation study results. Prepared for SWEPCO/CLECO by Central and South West Services, Dallas, Texas.

Harbert, T. 1982. Personal communication. Reclamation Specialist, Central and South West Services, Inc., Dallas, Texas.

Heartfield, L. and H. L. Clendenen. 1975. An archaeological assessment along certain proposed alternates of the Louisiana north-south expressway. Report prepared for Howard, Needles, Tammen and Bergendoff. Baton Rouge.

Heartfield, L., K. Hudson, G. R. Price, W. Mitcham, and S. Greene. 1978. A cultural resource survey and evaluation of the Opelousas to Shreveport portion of the proposed north-south expressway: phases I and II. Report prepared for Howard, Needles, Tammen and Bergendoff, Baton Rouge.

Heartfield, L., D. Price and G. Greene. 1982. A cultural resource survey of the Dolet Hills lignite prospect, De Soto Parish, Louisiana. Draft. Heartfield, Price and Greene, Inc.

Hershfield, D. M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. Technical Paper 40, Cooperative Studies Section, U.S. Weather Bureau. Washington, D.C.

Institute of Traffic Engineers. 1979. Trip generation.

Jackson, J. A. 1971. The evolution, taxonomy, distribution, past populations and current status of the Red-cockaded Woodpecker. In: Ecology and management of the Red-cockaded Woodpecker. R. L. Thompson (ed.). Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, Tall Timbers Research Station, Tallahassee, Florida. p. 4-265.

_____. 1978. Analysis of the distribution and population status of the Red-cockaded Woodpecker. In: Proceedings of the Rare and Endangered Wildlife Symposium R. R. Odumant and L. Sanders (eds.). Georgia Department of Natural Resources, Game and Fish Division, Technical Bulletin WL 4. p. 101-111.

Janssen, R. 1978. Noise and animals: perspective of government and public policy. In: Effects of Noise on Wildlife. J. L. Fletcher and R. G. Busnel (eds.). Academic Press, New York. p. 287-301.

Jeter, H. 1979. Personal communication. Regional Editor, Louisiana, Oklahoma, Texas. American Birds. National Audubon Society.

Karr, J. R. 1968. Habitat and avian diversity on strip-mined land in east-central Illinois. Condor 70:348-358.

Kennedy, J. L. and G. L. Pepper. 1980. Hydraulic properties and hydrogeologic mapping of reclaimed Gulf Coast lignite mines. In: Proceedings of Texas A&M University Lignite Symposium, April 17-18, 1980. Mathewson (ed.) Texas A&M University, College Station.

Kral, R. 1966. Observations on the flora of the southeastern United States with special reference to northern Louisiana. SIDA 2(6):395-408.

Louisiana Dept. of Natural Resources. 1980. Growth management plan for lignite impact area.

_____. 1982. 1981 timber and pulpwood production. Office of Forestry.

Louisiana Department of Transportation and Development. 1981. Louisiana highway traffic, 1981.

Louisiana Forestry Commission. 1977. Threatened, endangered or possibly extinct vascular plants in Louisiana. Dept. of Natural Resources, Office of Forestry, Baton Rouge.

Louisiana Health Systems Agency, Inc. 1980. Guidelines for development of long-term care facilities.

Louisiana Municipal Police Association. 1981. Manpower requirements.

Louisiana Office of Conservation. 1982. Letter to EPA, Region 6 dated 13 September 1982. Surface Mining Division.

Louisiana State Planning Office. 1975. Land use and data analysis (LUDA) program. U.S. Geological Survey, Baton Rouge.

Louisiana State University. 1978a. Agricultural statistics for Louisiana, 1964-1977. Department of Agricultural Economics and Agribusiness, Baton Rouge.

_____. 1978 b. Annual report.

_____. 1979. Annual report.

Louisiana Wildlife and Fisheries Commission. Undated. The fox and grey squirrels of Louisiana. 12 pp.

Lowery, G. H. 1974. The mammals of Louisiana and its adjacent waters. Louisiana State Univ. Press, Baton Rouge.

Lynch, T. E. and D. W. Speake. 1978. Eastern Wild Turkey behavioral responses induced by sonic boom. In: Effects of Noise on Wildlife. J. L. Fletcher and R. G. Busnel (eds.). Academic Press, New York. p. 47-61.

Mathewson, C. C., K. W. Brown, L. E. Deuely, D. G. Kersey. 1982. The impact of surface lignite mining on surface- and ground-water quality in Texas. Texas A&M Research Foundation, College Station, Texas. Prepared for U.S. Bureau of Mines. Contract No. J0295016.

Meyers, J. M. and A. S. Johnson. 1978. Bird communities associated with succession and management of loblolly shortleaf pine forests. In: Proceedings of the Worshop, Management of Southern Forests for Nongame Birds (R.M. DeGraaf, Technical Coordinator). U.S. Dept. of Agriculture - Forest Service, Southeastern Forest Experiment Station. Asheville, North Carolina. p. 50-65.

Miller, D., E. L. Boeker, R. S. Thorsell, and R. R. Olendorff. 1975. Suggested practices for raptor protection on powerlines. Prepared for Edison Electric Institute.

Miller, R. R. 1972. Threatened freshwater fishes of the United States. Trans. Amer. Fish. Soc. 101:239-252.

Mountain West Research, Inc. 1975. Construction worker profile. Old West Regional Commission. Washington, D.C.

Murray, G. E. 1948. Midway stratigraphy of Sabine uplift. AAPG Bulletin (abstract) 25:941-942.

National Bureau of Standards. 1959. Maximum permissible body burdens and maximum permissible concentrations of radionuclides in air and in water for occupational exposure; recommendations of the National Committee on Radiation Protection. NBS Handbook 69. U.S. Government Printing Office, Washington, D.C.

National Fire Protection Association. 1967. National fire protection guide.

National Research Council. 1977. Guidelines for preparing environmental impact statements on noise. Committee on Hearing, Bioacoustics and Biomechanics, Assembly of Behavioral and Social Sciences.

NCRP-45. 1975. Natural background radiation in the United States.

Olendorff, R. R. and others. 1981. Suggested practices for raptor protection on power lines - the state-of-the-art in 1981: University of Minnesota, Raptor Research Foundation, Inc., Raptor Research Report No. 4.

Page, L. V. and H. L. Pree, Jr. 1964. Water resources of De Soto Parish, Louisiana. U.S. Geological Survey Water Supply Paper 1774.

Partridge, T. 1982. Personal communication. Senior Ground-water Hydrologist, Espey, Huston & Associates, Inc.

Paul Wier, Co. 1981. Written communication - uranium and thorium Dolet Hills lignite analyses.

Porter, J. W. 1980. Pipeline and well survey, Dolet Hills lignite prospect.

Pramstaller, M. E. and W. S. Clark. 1979. Symposium on the status of the Bald Eagle and Bald Eagle Research, November 3, 1978. Raptor Information Center, National Wildlife Federation. 11 pp.

Pree, H. L. 1957. Geology and ground-water resources of De Soto Parish, Louisiana. U.S. Geological Survey, open file report.

Ramsey, A. F. and F. L. Corty. 1982. Prime agricultural lands of Louisiana: locations and losses to nonagricultural uses.

Robinson, L. 1982. Personal communication. Louisiana Department of Labor, Office of Employment Security, Dept. of Research Statistics.

Roland, H. L., Jr., G. M. Jenkins, and D. E. Pope. 1976. Mineral resources of Louisiana - lignite. Dept. of Conservation, Louisiana Geological Survey, Mineral Resources Bulletin, No. 2. 39 pp.

Rosholt, J. N., B. R. Doe, and M. Tatsumoto. 1966. Evolution of the isotopic composition of uranium and thorium in soil profiles: Geological Society America Bulletin, Volume 77, number 9.

Sargent and Lundy Engineers. 1978. An analysis of air quality impact of the proposed Dolet Hills project. Chicago, Illinois.

_____. 1980. Supplemental information, air quality analysis, Dolet Hills. Chicago, Illinois.

Schneider, W. J. 1977. Analysis of the densification of reclaimed surface-mine land. M.S. Thesis, Texas A&M University, College Station.

Shaeffer, H. D. 1982. Personal communication. Road Design Engineer, La. Dept. of Transportation and Development, Baton Rouge, La.

Shaw, E. A. G. 1978. Symposium on the effects of noise on wildlife. In: Effects of Noise on Wildlife J. L. Fletcher and R. G. Busnel. (eds.). Academic Press, New York. p. 1-5.

Smith, A. E. 1975. The impacts of lowland river management. Bird Study 22:249-254.

Smith, R. M. and A. A. Sobek. 1978. Physical and chemical properties of overburdens, spoils, wastes and new soils. In: Reclamation of Drastically Disturbed Lands. American Society of Agronomy. Madison, Wisconsin. p. 149-172.

Soil Conservation Service. 1965. Computer program for project formulation, hydrology. Technical Release No. 20, Supplement No. 1. U.S. Dept. of Agriculture. Washington, D.C.

_____. 1971. General soil map, De Soto Parish, Louisiana. Alexandria.

_____. 1972. National engineering handbook, section 4, hydrology. Washington, D.C.

Southwestern Electric Power Company. 1981. Steady-state water quality of Dolet Hills project. Shreveport, Louisiana.

_____/CLECO. 1980 & 1982. Unpublished in-house data.

Stockwell, T. 1981. Personal communication. Louisiana Dept. of Transportation and Development.

Stothart, G. 1982. Personal communication. Lignite Planner, Coordinating and Development Corporation. Shreveport, Louisiana.

TERA Corporation. 1981. Castor Bayou project, environmental information document. Vols. I and II.

_____. 1982. Castor Bayou project plan revisions. Dallas, Texas.

Thiessen, G. J., E. A. G. Shaw, R. D. Harris, J. B. Gollop, and H. R. Webster. 1957. Acoustic irritation threshold of Peking Ducks and other domestic and wild fowls. J.A.S.A. 29:1301-1306.

Transportation Research Board. 1976. Highway noise generation and control. Report 173. National Cooperative Highway Research Program.

U.S. Army Corps of Engineers. 1978. Preliminary guide to wetlands of the Gulf Coastal Plain. Technical Report Y-78-5, Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

U.S. Department of Agriculture, Soil Survey Staff. 1980. Soil survey of Caddo Parish, Louisiana. U.S. Governmental Printing Office.

U.S. Department of Army, Navy and Air Force. 1971. Dewatering and ground-water control for deep excavations.

U.S. Department of Commerce. 1970. Seismic risk map of the United States. NOAA Environmental Services Division. Publication 41-1.

_____. 1976. Climate of Louisiana. Climatography of the United States No. 60. Asheville, North Carolina.

_____. 1978. Local climatological data for Shreveport, Louisiana. Asheville, North Carolina.

_____. 1975. Surface wind observations 1970-1974 for Shreveport, Louisiana (processed through National Climatic Center's STAR computer program). Asheville, North Carolina.

U.S. Department of Commerce, Bureau of Census. 1971. 1970 census of population, Louisiana.

_____. 1981. 1980 census of housing and population, advance report, Louisiana.

U.S. Department of Commerce, Bureau of Economic Analysis. 1979. The input-output structure of the U.S. economy, 1972. Survey of Current Business.

_____. 1981. Local area personal income by industry source, 1974-1979.

U.S. Department of Housing and Urban Development. 1980. Noise assessment guidelines. Office of Policy Development and Research.

U.S. Environmental Protection Agency (EPA). 1974. Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety. Office of Noise Abatement and Control.

_____. 1977a. Technical guidance for control of industrial process fugitive particulate emissions. EPA-450/3-77-010. Research Triangle Park, North Carolina.

_____. 1977b. Toward a national strategy for noise control. Office of Noise Abatement and Control.

_____. 1978a. Fugitive emissions from integrated iron and steel plants. EPA-600/2-78-050. Research Triangle Park, North Carolina.

_____. 1978b. Protective noise levels: condensed version of EPA levels document. Office of Noise Abatement and Control.

_____. 1979. Radiological impacts caused by emissions of radionuclides into air in the United States. EPA-520/7-79-006.

_____. 1981. EIS-Dolet Hills Power Plant Project, Northwestern Louisiana. Region 6, Dallas, Texas. EPA 906/9-81-004.

_____. 1982. Henry W. Pirkey Power Plant Dept-1/South Hallsville Surface Lignite Mine Project. Harrison County, Texas.

U.S. Fish and Wildlife Service. 1978. Impacts of coal-fired power plants on fish, wildlife, and their habitats. FWS/OBS-78/29, March 1978.

_____. 1982. Letter dated 3 August 1982 to U.S. Environmental Protection Agency, Dallas, Texas.

University of New Orleans. 1977. Statistical abstract of Louisiana. Division of Business and Economic Research, New Orleans.

University of Texas School of Public Health and Espey, Huston & Associates, Inc. 1982. Analysis of potential adverse human health effects due to airborne emissions from the Fayette Power Project and the Cummins Creek Mine. Prepared for the Lower Colorado River Authority, Austin, Texas.

Vienne, C. 1979. Personal communication. Louisiana Department of Wildlife Fisheries, Alexandria.

Von Hake, C. A. 1977. Earthquake history of Texas. USGS Earthquake information bulletin. Vol. 9, No. 3.

Wheeler, F. F. 1982. Personal communication. Soil Conservationist. SCS. Temple, Texas.

Wildersonn. 1981. Personal communication. City of Mansfield, bookkeeper.

Williamson, K. 1971. A bird census study of a Dorset dairy farm. Bird Study 18:80-96.

Wray, T., II, K. A. Strait, and R. C. Whitmore. 1982. Reproductive success of grassland sparrows on a reclaimed surface mine in West Virginia. The Auk 99(1):157-164.

9.0 GLOSSARY

Acid Rain. Specifically, rain of low pH (usually less than 5.7) that has been postulated to have many detrimental effects on calcareous structures or on aquatic and terrestrial systems in areas with low buffering capacity. Caused by airborne gases and soluble particles that form acids in rainwater, either emitted from man-made (industrial, automobiles) or natural (fires, volcanoes) sources. In general use, includes dry deposition of acidifying materials as well.

Alluvial. Clay, silt, sand, gravel, or similar detrital material deposited by running water, especially during recent geologic time.

Ambient. The surrounding environment or atmosphere.

Ancillary. Subsidiary or supplementary.

Aquifer. A water-bearing bed or stratum of permeable rock, sand, or gravel, capable of yielding considerable quantities of water to wells or springs.

Baseline. Existing conditions.

Berm. A strip of ground along a dike or the level space between the edge of a ditch and the bank of earth excavated from it.

Biomass. The amount of living matter in the form of one or more kinds of organisms present in a particular habitat usually expressed as weight of organisms per unit area of habitat or as volume or weight of organisms per unit volume of habitat.

Chlorination. The application of chlorine to water or wastewater, generally for the purpose of disinfection, but frequently for accomplishing chemical results, such as oxidation of odor-producing compounds.

Circumneutral pH. Around neutral pH (~7.)

Conductivity. The ability to carry an electrical charge, in ions. The conductivity of aqueous solutions is increased by dissolved salts and thus is a measure of the amount of ionized salts in solution.

Convective Showers. Precipitation falling from clouds induced by the solar heating of moist, unstable air.

Cubic feet per second (cfs). Units used to measure flow at a gaging station; equals the rate of flow in a channel with a one-square-foot cross-section and velocity of one foot per second. One cfs for a 24-hour period equals 86,400 cubic feet or 1.98 acre-feet.

Depressurization: Lowering the pressure of an aquifer, usually by pumping.

dBA. The sound level obtained by the use of A-weighting. The unit is the decibel, dB, and is followed by the letter A to indicate A-weighting. The A-weighting network best simulates the human ear's response to sound pressure.

Dewater. Removal of water.

Dissolved Oxygen (DO). In the course of breaking down excess organic matter in water, microbes may deplete the level of dissolved oxygen, causing stress from lack of oxygen on fish and other aquatic life in the same ecosystem.

Diversion. A channel constructed to divert water from one course or body of water to another.

Ecosystem. A community and its environment treated together as a functional system of complimentary relationships involving the transfer and circulation of energy and matter.

Ecotone. A transitional area between two adjacent ecological communities usually exhibiting competition between organisms common to both.

Effluent. Wastewater or other liquid, partially or completely treated, flowing out of a reservoir, basin, or treatment plant.

Ephemeral. Lasting or existing briefly; temporary; transient.

Evaporation. A physical process by which a liquid is transformed into a gaseous state.

Fecal Coliforms. A large and varied group of bacteria flourishing in the intestines and feces of warm-blooded animals, including man. Large amounts of these bacteria in the water indicate sewage or feedlot pollution.

Floodplain. Level land that may be submerged by floodwaters; or a plain built up by stream deposition.

Floristics. A branch of phytogeography that deals numerically with plants and plant groups.

Fluvial. Relating to, or produced by stream or river action.

Fugitive Emissions. Air pollutant emissions that cannot be traced to a particular point or stack.

Heavy Metals. Soluble trace elements found in the coal that tend to concentrate in the waste by products and that are leachable and potentially toxic.

Heterogeneity. The quality or state of consisting of dissimilar ingredients or constituents.

Herpetofauna. Reptiles and amphibians.

Hydrology. A science dealing with the properties, distribution, and circulation of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

Infiltration. To enter, permeate, or pass through a substance or area by filtering gradually.

Infrastructure. The underlying foundation or basic framework, as in a system or organization.

In-migration. Movement of population into a community or region.

$L_{(dn)}$. Day-Night Sound Level. The 24-hour equivalent sound level with a penalty value of 10 dBA added to the average levels occurring during the nighttime hours of 10:00 p.m. to 7:00 a.m.

Lignite. A brownish-black coal in which the alteration of vegetal matter has proceeded further than peat, but not so far as sub-bituminous coal.

Lithological. Pertaining to the study of rocks and rock formations.

Littoral. Of or relating to or on or near a shore.

Long-term. Occurring over or involving a relatively long period of time.

Mean Sea Level (msl). The average height of the sea for all stages of the tide.

Microbiocides. A substance that is destructive to many different microbes, microorganisms in particular.

Milligrams per liter (mg/l). One part by weight of dissolved chemical, or suspended sediment, in 7 million parts by volume (= 1 liter) of water (see parts per million).

Million gallons per day (mgd). A unit of measurement for expressing the flow rate of water through a certain point.

Millirem. A unit of radiation dosage, a thousandth of a roentgen (rem).

Mitigate. To make less harsh or severe.

Monitoring. Periodic or continuous determination of the amount of pollutants present in the environment.

National Pollutant Discharge Elimination System (NPDES). The permitting system authorized under Section 402 of the Clean Water Act, including any state or interstate program that has been approved by the Administrator, in whole or in part, pursuant to Section 402.

Overburden. Consolidated or unconsolidated material overlying a deposit of useful geological material (minerals, ores, lignite, or coal) especially where mined by open cuts.

Parts per million (ppm). One part by weight of dissolved chemical or suspended sediment in 1 million parts by weight of water.

Particulates. Small particles of solid or liquid materials that, when suspended in the atmosphere, constitute an atmospheric pollutant.

Passerine Birds. Songbirds with perching habits.

pH. The measure of hydrogen-ion activity in solution. Expressed on a scale of 0 (highly acid) to 14 (alkaline). pH 7.0 is a neutral solution, neither acid not alkaline.

Piezometer. An instrument for measuring pressure or compressibility of a material subjected to hydrostatic pressure.

Preempt. To acquire by taking the place of: replace.

Radionuclide. A radioactive species of atom characterized by the energy level and the number of protons and neutrons contained in its nucleus.

Radiation. The emission of energy in the form of waves or particles.

Reclamation. Restoration to the original or some other use.

Revegetation. To provide a new vegetative cover for land previously stripped of vegetation.

Riparian. Relating to the bank of a natural water course, such as a river, lake, or stream.

Runoff. The portion of the precipitation on the land that ultimately reachs a stream(s), especially from rain that flows over the surface.

Sediment Control. The planning and construction of facilities for prevention of excessive damage by water in flood stages.

Short-term. Occurring or involving a short period of time.

Spoil piles. Piles of debris or waste material from a coal mine.

Stagnating Anticyclone. A area of slow-moving high pressure, dominated by light winds and limited vertical dispersion of pollutants.

Subsidence. The act or process of sinking or falling to the bottom; to settle or to tend downward, descend.

Temperature Inversion. A stable layer in the atmosphere in which temperature increases with altitude.

Topography. The configuration of a surface including its relief and position of its natural and manmade features.

Total Dissolved Solids (TDS). The anhydrous residues of dissolved constituents in water. Actually, the term is defined by the method used in determination. Standard Methods are used in water and wastewater treatment.

Total Suspended Solids (TSS). The sum of the solids that either float on the surface or are in suspension in water, wastewater, or other liquids. These can be removed by filtering.

Turbidity. Defined as capacity of material suspended in water to scatter light. Highly turbid water is often called "muddy", although all manner of suspended particles contribute to turbidity.

Wastewater. The spent water of a plant or a community. A combination of liquid and water-carried wastes from residences, commercial buildings, industrial plants, and/or institutions.

Watershed. A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

"Worst Case". A situation in which the combination of factors that would produce the worst potential impact on the environment are considered.

100-Year Floodplain. Land that becomes/or will become submerged by a flood that chances to occur every 100 years.

List of Abbreviations /
Conversion Table

LA/CT/D

LIST OF ABBREVIATIONS

NPDES	National Pollutant Discharge Elimination System
DHMV	Dolet Hills Mining Venture
SEIS	Supplemental Environmental Impact Statement
EIS	Environmental Impact Statement
SWEPCO	Southwestern Electric Power Company
CLECO	Central Louisiana Electric Company, Inc.
EPA	United States Environmental Protection Agency
NEPA	National Environmental Policy Act of 1969
FWPCA	Federal Water Pollution Act (P.L. 92-500)
SCS	Soil Conservation Service
NSPS	New Source Performance Standards
LDNR	Louisiana Department of Natural Resources
RN-222	Radon-222
$L_{(dn)}$	day-night noise level
dBA	decibels (A-weighted)
USCE	United States Army Corps of Engineers
FWS	United States Fish and Wildlife Service
NRHP	National Register of Historic Places
MOA	Memorandum of Agreement
LA	Louisiana
CFR	Code of Federal Regulations
CWA	Clean Water Act
LOCSMD	Louisiana Office of Conservation, Surface Mining Division
SHPO	State Historic Preservation Officer
ACHP	Advisory Council on Historic Preservation
USDA	United States Department of Agriculture
mmtpy	million tons per year
EH&A	Espey, Huston & Associates, Inc.
Hwy	highway
LSMR	Louisiana Surface Mining Regulations
BTU	British thermal unit
USDA	United States Department of Agriculture
msl	mean sea level
USGS	United States Geological Survey

LIST OF ABBREVIATIONS (Concluded)

NASA	National Aeronautics and Space Administration
csm	cubic feet per second per square mile
mph	miles per hour
tsp	total suspended particulate
TACB	Texas Air Control Board
PSD	Prevention of Significant Deterioration
WL	Working-Level
U-238	Uranium-238
HUD	United States Department of Housing and Urban Development
FHWA	Federal Highway Administration
L_{eq}	equivalent sound level
ROW	right of way
dbh	diameter-at-breast height
kV	Kilovolt
mg/l	milligrams per liter
NHPA	National Historic Preservation Act
CDC	Coordinating and Development Corporation
ADT	average daily traffic
mgd	million gallons per day
RRC	Texas Railroad Commission
NAAQS	National Ambient Air Quality Standards
DOI	United States Department of Interior
LDTD	Louisiana Department of Transportation and Development
FEMA	Federal Emergency Management Agency
gpm	gallons per minute
ppm	parts per million
I	Interstate
kph	kilometers per hour

METRIC CONVERSION FACTORS

(International System of Units)

Quantity	Symbol	English	Multiply by	Metric	Symbol
Length					
	in	inches	2.54	centimeters	cm
	ft	feet	30.48	centimeters	cm
	yd	yard	0.91	meters	m
	mi	miles	1.61	kilometers	km
Area					
	in^2	square inches	6.45	square centimeters	cm^2
	ft^2	square feet	0.09	square meters	m^2
	yd^2	square yards	0.84	square meters	m^2
	mi^2	square miles	2.59	square kilometers	km^2
	ac	acre	0.41	hectares	ha
Mass (weight)					
	oz	ounces (avdp)	28,350.00	milligrams	mg
	oz	ounces (avdp)	28.35	grams	g
	lb	pounds	0.45	kilograms	kg
	t	short tons (2,000 lbs)	0.91	tons (metric)	t
Temperature					
	°F	Fahrenheit degrees	5/9 (after subtracting 32)	Celsius degrees	°C
Pressure					
	psi:	pounds per square inch	703.07	kilograms per square meter	kg/m^2
Volume					
	fl oz	fluid ounces	29.573	milliliters	ml
	qt	quarts	0.946	liters	l
	gal	gallons	3.785	liters	l
	ft^3	cubic feet	0.028	cubic meters	m^3
	yd^3	cubic yards	0.765	cubic meters	m^3
	bbl	barrels (oil)	0.159	cubic meters	m^3
	ac-ft	acre-feet	1,233.487	cubic meters	m^3
Speed (velocity)					
	ft/s	feet per second	0.3048	meters per second	m/s
	ft/s	feet per second	0.0003	kilometers per second	km/s
	ft/min	feet per minute	0.5080	centimeters per	cm/s
	mi/hr	miles per hour	0.4470	meters per second	m/s
	mi/hr	miles per hour	1.6093	kilometers per hour	km/hr
	mi/hr	miles per hour	0.8684	knots	kts

METRIC CONVERSION FACTORS (Concluded)

Quantity	Symbol	English	Multiply by	Metric	Symbol
Energy					
	Btu	British thermal units	0.0002928	kilowatt hours	KWh
	hp	horse power	0.74570	kilowatts	kw
Flow Rate					
	gal/min	gallons per minute	0.0630907	liters per second	l/s
	gal/d	gallons per day	0.0037854	kiloliters per day	kl/da
	tpy	tons per year	0.9071850	metric tons per year	tpy
	cfs	cubic feet per second	0.0283170	cubic meters per second	m^3/s

APPENDICES

APPENDIX A

Draft NPDES Permit

Permit No. LA0064076
Application No. LA0064076

Draft

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

Dolet Hills Mining Venture
South Park Office Plaza, Suite 209/210
9029 Mansfield Road
Shreveport, Louisiana 71118

is authorized to discharge from a facility located Dolet Hills Lignite Project near Mansfield, De Soto Parish, Louisiana

to receiving waters various tributaries to the Sabine River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Signed this day of

Myron O. Knudson, P.E.
Director, Water Management Division (6W)

PART I
REQUIREMENTS FOR NPDES PERMITS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - Outfall 001, sedimentation pond discharge ***

During the period beginning the effective date and lasting through the expiration of this permit

the permittee is authorized to discharge from Outfall(s) serial number(s) 001, sedimentation pond discharge ***.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations			
	kg/day(lbs/day)		Other Units (Specify)	
	Daily Avg	Daily Max	Daily Avg	Daily Max
Flow-m^3/Day(MGD)	N/A	N/A	*	*
Total Suspended Solids	N/A	N/A	35.0 mg/l	70.0 mg/l
Total Iron	N/A	N/A	3.0 mg/l	6.0 mg/l
Total Manganese	N/A	N/A	2.0 mg/l	4.0 mg/l

Effluent Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	1/day**	Estimate****
Total Suspended Solids	1/day**	Grab
Total Iron	1/day**	Grab
Total Manganese	1/day**	Grab

* Report
** During periods of discharge
*** See Part III, Paragraph G.
**** See Part III, Paragraph B.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/day** by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): At the flow measuring device at the discharge from the sedimentation pond.

PART I
REQUIREMENTS FOR NPDES PERMITS

SECTION A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - Outfall SIJ and SIV, treated sanitary sewage discharge to sedimentation ponds OIJ and OIV, respectively

During the period beginning the effective date and lasting through the expiration of this permit

the permittee is authorized to discharge from Outfall(s) serial number(s) SIJ and SIV, treated sanitary sewage discharge to sedimentation ponds OIJ and OIV, respectively .

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations kg/day(lbs/day) Daily Avg	Discharge Limitations kg/day(lbs/day) Daily Max	Other Units (Specify) Daily Avg	Other Units (Specify) Daily Max
Flow-m^3/Day(MGD)	N/A	N/A	*	*
Total Suspended Solids	N/A	N/A	30 mg/l	45 mg/l
Biochemical Oxygen Demand (5-day)	N/A	N/A	30 mg/l	45 mg/l

Effluent Characteristic	Monitoring Requirements Measurement Frequency	Monitoring Requirements Sample Type
Flow-m^3/Day(MGD)	Daily	Estimate
Total Suspended Solids	1/week	Grab
Biochemical Oxygen Demand (5-day)	1/week	Grab

* Report
** Delete

The pH shall not be less than N/A standard units nor greater than N/A standard units and shall be monitored N/A.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Prior to discharge to the sedimentation pond.

SECTION B. SCHEDULE OF COMPLIANCE

The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

NONE

Dra

Draft

PART II
STANDARD CONDITIONS FOR NPDES PERMITS

SECTION A. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

2. Penalties for Violations of Permit Conditions

The Clean Water Act provides that any person who violates a permit condition implementing sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing sections 301, 302, 306, 307, or 308 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or both.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

5. Toxic Pollutants

Notwithstanding paragraph A-4, above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the permittee so notified.

The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" Section B, Paragraph B-3 and "Upsets" Section B, Paragraph B-4, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

Draft

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs c and d of this section.

c. Notice

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten days before the date of the bypass.

Draft

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Section D, Paragraph D-6 (24-hour notice).

d. Prohibition of bypass.

(1) Bypass is prohibited and the Director may take enforcement action against a permittee for bypass, unless:

(a) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notices as required under paragraph c of this section.

(2) The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed above in paragraph d(1) of this section.

4. Upset Conditions

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of paragraph c of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

Draft

(1) An upset occurred and that the permittee can identify the specific cause(s) of the upset;

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in Section D, Paragraph D-6.

(4) The permittee complied with any remedial measures required under Section A, Paragraph A-3.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

Draft

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and, unless otherwise specified, before the effluent joins or is diluted by any other wastestream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10% from true discharge rates throughout the range of expected discharge volumes. Guidance in selection, installation, calibration and operation of acceptable flow measurement devices can be obtained from the following references:

a. "A Guide to Methods and Standards for the Measurement of Water Flow", U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 421, May 1975, 97 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by SD catalog No. C13.10:421).

b. "Water Measurement Manual", U. S. Department of Interior, Bureau of Reclamation, Second Edition, Revised Reprint, 1974, 327 pp. (Available from the U. S. Government Printing Office, Washington, D. C. 20402. Order by Catalog No. I27.19/2:W29/2, Stock No. S/N 24003-0027).

c. "Flow Measurement in Open Channels and Closed Conduits, U. S. Department of Commerce, National Bureau of Standards, NBS Special Publication 484, October 1977, 982 pp. (Available in paper copy or microfiche from National Technical Information Service (NTIS), Springfield, VA 22151. Order by NTIS No. PB-273 535/5ST).

d. "NPDES Compliance Sampling Manual", U. S. Environmental Protection Agency, Office of Water Enforcement, Publication MCD-51, 1977, 140 pp. (Available from the General Services Administration [8FFS], Centralized Mailing Lists Services, Building 41, Denver Federal Center, Denver, CO 80225).

Draft

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties for Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

5. Reporting of Monitoring Results

Monitoring results must be reported on a Discharge Monitoring Report (DMR) form (EPA No. 3320-1). Monitoring results obtained during the previous 3 months shall be summarized for each month and reported on a DMR form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due __________________. Duplicate copies of DMR's signed and certified as required by Section D, Paragraph D-11, and all other reports required by Section D, Reporting Requirements, shall be submitted to the Regional Administrator and the State at the following addresses:

Myron O. Knudson, P.E., Director
Water Management Division (6W)
U.S. Environmental Protection Agency
Region VI
First International Building
1201 Elm Street
Dallas, Texas 75270

J. Dale Givens, Administrator
Water Pollution Control Division
Office of Environmental Affairs
Louisiana Dept. of Natural Resources
P.O. Box 44066
Baton Rouge, Louisiana 70804

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless other wise specified by the Director in the permit.

Draft

8. Retention of Records

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Record Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

Draft

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit is nontransferable to any person except after notice to the Director. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

4. Monitoring Reports

Monitoring results shall be reported at the intervals and in the form specified in Section C, Paragraph C-5 (Monitoring).

5. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

6. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

Draft

The following shall be included as information which must be reported within 24 hours:

a. Any unanticipated bypass which exceeds any effluent limitation in the permit.

b. Any upset which exceeds any effluent limitation in the permit.

c. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in Part III of the permit to be reported within 24 hours.

7. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under Section D, Paragraphs D-1, D-4, D-5, and D-6 at the time monitoring reports are submitted. The reports shall contain the information listed in Paragraph D-6.

8. Changes in Discharges of Toxic Substances

The permittee shall notify the Director as soon as it knows or has reason to believe:

a. That any activity has occurred or will occur which would result in the discharge of any toxic pollutant which is not limited in the permit, if that discharge will exceed the "notification levels" described in 40 CFR 122.61.

b. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

9. Duty to Provide Information

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

10. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

11. Signatory Requirements

All applications, reports or information submitted to the Director shall be signed and certified.

a. All permit applications shall be signed as follows:

(1) For a corporation: by a principal executive officer of at least the level of vice-president;

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

b. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described above.

(2) The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

12. Availability of Reports

Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency

Draft

and the Regional Administrator. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

13. Penalties for Falsification of Reports

The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

PART III
OTHER CONDITIONS

A. The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during that calendar day.

The "daily maximum" concentration means the daily determination of concentration for any calendar day.

B. Methods of flow estimating shall be by the "California Pipe Method" as described in section 7.4.2.2. of the Handbook for Monitoring Industrial Wastewater, August 1973, U.S. Environmental Protection Agency, Technology Transfer.

C. Effluent Limitations for Precipitation events

(a) Any discharge or increase in the volume of a discharge caused by precipitation less than or equal to the 10-year, 24-hour precipitation event (or series of storms or snowmelt of equivalent volume) may comply with the following limitations instead of the otherwise applicable limitations:

Effluent Limitations During Precipitation

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
Settleable Solids	0.5 ml/l	N/A
pH	Within the range of 6.0 to 9.0 at all times	

(b) Any discharge or increase in volume of a discharge caused by precipitation greater than the 10-year, 24-hour event (or series of storms or snowmelt of equivalent volume) may comply with the following limitations instead of the otherwise applicable limitations:

Effluent limitations During Precipitation

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
pH	Within the range of 6.0 to 9.0 at all times	

(c) The operator shall have the burden of proof that the discharge or increase in discharge was caused by the applicable precipitation event described in subsections (a) and (b).

D. 10-year 24-hour Precipitation Event

The term "10-year, 24-hour precipitation event" means the maximum 24-hour precipitation event with a probable recurrence interval of once in ten years as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S.," May 1961, or equivalent regional or rainfall probability information developed therefrom.

E. Effluent Limitations for Reclamation Areas

The following standards apply to discharges from reclamation areas until SMCRA bond release

Effluent Limitations

Pollutant or Pollutant Property	Maximum for any one day	Average of daily values for thirty consecutive days
Settleable Solids	0.5 ml/l	N/A
pH	Within the range 6.0 to 9.0 at all times	

F. Determination of Settleable Solids

The following procedure shall be used to determine settleable solids:

Fill an Imhoff cone to the one-liter mark with a thoroughly mixed sample. Allow to settle undisturbed for 45 minutes. Gently stir along the inside surface of the cone with a stirring rod. Allow to settle undisturbed for 15 minutes longer. Record the volume of settled material in the cone as milliliters per liter. Where a separation of settleable and floating materials occurs, do not include the floating material in the reading.

The method detection limit for measuring settleable solids shall be 0.4 ml/l.

Draft

G. Initial Discharge Location

Discharge Serial No.	Latitude	Longitude	Receiving Stream
01A	31° 58' 24"	93° 28' 46"	West Branch Dolet Bayou
01B	31° 58' 21"	93° 28' 32"	West Branch Dolet Bayou
01C	31° 58' 12"	93° 28' 12"	West Branch Dolet Bayou
01D	31° 57' 45"	93° 27' 42"	West Branch Dolet Bayou
01E	31° 57' 38"	93° 27' 36"	West Branch Dolet Bayou
01F	31° 57' 28"	93° 29' 35"	Blanchard Bayou
01G	31° 57' 32"	93° 29' 32"	Blanchard Bayou
01H	31° 57' 34"	93° 29' 25"	Blanchard Bayou
01I	31° 57' 26"	93° 29' 05"	Blanchard Bayou
01J	31° 57' 22"	93° 28' 14"	Dead Negro Bayou
01K	31° 57' 13"	93° 28' 23"	Dead Negro Bayou
01L	31° 56' 35"	93° 29' 56"	Louies Bayou
01M	31° 56' 48"	93° 29' 46"	Louies Bayou
01N	31° 56' 54"	93° 29' 31"	Louies Bayou
01O	31° 57' 00"	93° 29' 33"	Louies Bayou
01P	31° 56' 59"	93° 29' 16"	Louies Bayou
01Q	31° 56' 57"	93° 28' 47"	Louies Bayou
01R	31° 57' 11"	93° 28' 45"	Louies Bayou
01S	31° 57' 11"	93° 28' 00"	Louies Bayou
01T	31° 57' 06"	93° 27' 51"	Louies Bayou
01U	31° 56' 49"	93° 27' 27"	Prairie Bayou
01V	32° 02' 32"	93° 37' 52"	Five Mile Bayou
01W	32° 02' 20"	93° 37' 59"	Five Mile Bayou

H. Locations may be revised by the permittee if it becomes necessary to eliminate or establish new holding ponds. For any revision the permittee shall submit appropriate maps redesignating the holding pond location.

The permittee shall notify EPA and LDNR as each new holding pond (discharge point) is developed and also when each discharge point is discontinued.

Any revised pond or outfall location should be consistent with and fall within the mining area boundary as defined in the applicant's State Mining Plan.

Any revised pond or outfall location shall be limited to discharging to the same receiving body of water.

APPENDIX B

Permit Area Sedimentation Pond
Conceptual Requirements

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Sabine River Basin
San Patricio Drainage Area)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6448.19	--	183	87.4	9	96	2001
6348.96	--	154	73.6	15	89	2004
6348.93	--	160	76.4	16	92	2005
6447.09	46	596	300.5	60	361	2003
6448.06[f]	--	154	73.6	15	89	2008
6448.03[f]	--	160	76.4	16	92	2008

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acre of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

f. Permanent structure.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Sabine River Basin
Chatman Bayou Drainage Area)

Pond Number[a]	Watershed (acres) Undisturbed	Watershed (acres) Disturbed	Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
6448.89	--	814	373.2	81	454	2003
6448.88	46	860	424.0	86	510	1995
6448.98	--	804	384.0	80	464	1991
6448.94	--	369	176.3	37	213	2003
6548.02	40	878	438.5	88	527	1999
6448.83	20	220	112.3	22	134	2000
6447.89	--	332	158.6	33	192	2000
6547.18	436	367	345.1	37	382	2002
6548.50	--	344	164.3	34	198	2000
6547.69[f]	--	310	139.2	31	170	2000
6547.77	--	298	142.3	30	172	1999
6547.16	436	367	345.1	37	382	2002
6547.25	275	400	309.2	40	349	2004
6547.23	115	574	315.9	57	373	2006
6447.93	--	338	161.7	34	196	2008
6547.02	332	424	332.1	42	374	2007

---

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

f. Permanent structure.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Sabine River Basin
Ten Mile Bayou Drainage Basin)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6648.21	161	--	62.6	1	64	1995
6648.31	--	298	142.3	30	172	1997
6647.17	275	--	105.3	2	107	1995
6647.18	--	241	115.1	24	139	1997
6647.02	--	240	114.6	24	139	1996
6647.22[f]	--	734	350.9	73	424	1994
6648.42	--	436	208.3	44	252	1997

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

f. Permanent structure.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Four Mile Bayou Drainage Basin)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6449.35	--	182	86.9	18	105	2001
6449.34	14	110	58.0	11	69	2000
6449.44	10	16	11.4	2	13	1999
6449.58	10	35	20.2	4	24	1993
6450.5063	2	6	3.7	1	5	1998
6450.5069	--	8	3.8	1	5	1998
6450.51	--	12	5.7	1	7	1998
6450.52	--	6	2.9	1	4	1998
6450.62	10	20	13.5	2	16	1998

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Five Mile Bayou Drainage Basin)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6450.92	7	7	6.0	1	7	1998
6450.81	8	30	17.4	3	20	1998
6450.90	28	34	27.2	3	30	1995

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Clifton Bayou Drainage Basin)

Pond Number[a]	Watershed (acres) Undisturbed	Watershed (acres) Disturbed	Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
6549.07	20	134	72.1	13	85	1994
6549.17	115	482	273.7	48	322	1991
6549.47	11	47	26.6	5	32	1993
6549.56	--	72	34.4	7	41	1993
6549.65	23	85	49.5	9	59	1992

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Mundy Bayou Drainage Basin)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6549.73	--	41	19.6	4	24	1991
6549.83	--	79	37.7	8	46	1990
6549.92	--	14	6.7	1	8	1990
6549.91	--	12	5.7	1	7	1990
6649.21	325	691	454.1	69	523	1990

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Fraigeson Creek Drainage Basin)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6748.09	--	32	15.3	3	18	1994
6748.16	25	365	182.5	37	220	1994

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS

(Red River Basin
West Branch Dolet Bayou Drainage Area)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6747.39	100	1,460	730.1	146	876	1993
6748.13	17	40	25.6	4	30	1994
6747.48	53	480	249.5	48	298	2007
6747.58	--	24	11.5	2	14	2008
6747.97	--	50	23.9	5	29	2007
6847.26	2	24	12.2	2	14	1991
6847.57	2	35	17.7	4	22	1991
6847.68	10	56	30.3	6	36	1991
6847.78	1	43	21.0	4	25	1990
6847.87	2	32	15.9	3	19	1990
6847.98	2	46	22.9	5	28	1989
6947.08	10	25	15.8	3	19	1989
6947.17	--	23	11.0	2	13	1989
6947.66	11	57	31.2	6	38	1986
6947.76	--	46	21.5	5	27	1986
6947.95	--	55	25.7	6	32	1986
7047.12	5	99	49.7	10	60	1986
7047.21	--	68	32.5	7	40	1986

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
West Branch Dolet Bayou Drainage Area) (Concluded)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
ROCKY BRANCH SUB-AREA						
6747.76	--	992	473.8	99	573	2008
CAVE BRANCH SUB-AREA						
6847.06	4	42	21.5	4	26	2008
6847.15	35	935	459.9	94	554	1992

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Blanchard Bayou Drainage Basin)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6847.73	40	143	83.9	14	98	1991
6847.72	40	470	239.8	47	287	1991
6847.92	--	160	76.4	16	92	1990
6847.91	36	10	18.5	1	20	1994
6947.2100	22	64	38.9	6	45	1987
6947.2135	20	166	96.4	19	115	1987
6947.2196	23	45	30.5	5	36	1987
6947.40	--	70	33.4	7	40	1987

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Dead Negro Branch Drainage Basin)

Pond Number[a]	Watershed (acres) Undisturbed	Disturbed	Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
6947.90	20	531	263.2	53	316	1986
6946.89	20	4	9.6	1	10	1987

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS

(Red River Basin
Louies Bayou Drainage Basin)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6846.95	--	114	51.2	11	62	2010
6846.57	70	320	179.6	32	212	2009
6846.96	--	180	86.0	18	104	1993
6946.05	10	128	65.0	13	78	2010
6946.07	--	190	90.8	19	110	1994
6946.17	--	114	54.5	11	66	1988
6946.27	--	58	27.7	6	34	1988
6946.28	25	95	55.0	10	65	1987
6946.38	--	45	21.5	5	27	1988
6946.67	--	275	131.4	28	159	1988
6946.69	--	55	26.3	6	32	1987
7046.09	--	46	22.0	5	27	1986
7046.18	39	115	70.6	12	83	1987

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Prairie Bayou Drainage Area)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
6846.80	--	126	60.2	13	73	2014
6845.78	128	230	157.3	23	180	2016
6945.29[f]	--	454	216.9	45	262	2013
6945.39	--	454	216.9	45	262	2011
6945.48	--	31	14.8	3	18	2017
6945.58	68	104	75.6	11	87	2017
6945.56[f]	--	230	109.9	23	133	2017
6946.30	--	186	88.8	19	108	2011
6946.5100[f]	--	241	115.1	24	139	2017
6946.5177[f]	--	72	34.5	7	42	2017
6946.5132	--	40	19.1	4	23	2014
6946.62	--	168	80.2	17	97	2014
6946.63	--	77	36.8	8	47	2014
6946.7400	--	45	21.5	5	27	2014
6946.7434[f]	--	115	54.9	12	67	2015
6946.84	--	68	32.5	7	40	2014
6946.95	--	46	22.0	5	27	1989

PERMIT AREA SEDIMENTATION POND
CONCEPTUAL REQUIREMENTS
(Red River Basin
Prairie Bayou Drainage Area) (Concluded)

Pond Number[a]	Watershed (acres)		Runoff Volume[b] (ac-ft)	Sediment Storage[c] (ac-ft)	Total Pond Volume[d] (ac-ft)[e]	Start Date of Operation
	Undisturbed	Disturbed				
7046.06	--	20	9.6	2	12	1990
7046.37	--	46	22.0	5	27	1987

a. Number designation based on North Zone Louisiana State plane coordinates.

b. Runoff is based on a 7.4 in, 10-yr, 24-hr rainfall event using methods of Chapter 10, Section 4 Hydrology, of the National Engineering Handbook (Mockus, 1964).

c. Sediment Storage is based on Rule 216.46(b)(2) at 0.1 ac-ft of sediment storage per acres of disturbed area (Louisiana Office of Conservation, Surface Mining Division).

d. Total design volume will be greater than shown to provide for flood storage.

e. See Conversion Chart for conversion to metric equivalent.

f. Permanent structures.

APPENDIX C

Overburden and Lignite

Physical/Chemical Analysis Data

TABLE I

PHYSICAL AND CHEMICAL PROPERTIES OF ELEVEN OVERBURDEN CORES
PAUL WEIR COMPANY 1979

Core Number	Depth (ft)	Particle Size Analysis(%)			Textural Class	Water Holding Capacity (%)	pH (Sat. Paste)	Total Sulfur (%)	Acid-[a] Base Potential	Tot.Exch[b] Bases	CEC[b]	OC (%)	P (ppm)	K (ppm)
		Sand	Silt	Clay										
1	0- 4.5	49.9	21.1	31.9	Sandy Clay Loam	12.50	5.0	0.01	-0.31	5.7	17.0	.28	4.0	7.3
	4.5- 11.1	8.7	59.0	32.3	Silty Clay Loam	16.95	4.3	0.03	-0.94	13.9	24.0	.08	8.0	12.2
	11.1- 23.2	70.7	16.6	12.7	Sandy Loam	10.13	4.6	0.06	-0.38	9.8	10.0	.04	4.0	5.7
	23.2- 28.2	24.5	41.5	34.1	Clay Loam	13.22	7.0	0.18	+4.37	19.61	14.0	.80	8.0	20.8
	28.2- 33.3	11.9	53.9	34.2	Silty Clay Loam	14.00	7.4	0.25	+3.91	23.1	20.0	1.21	8.0	21.6
	33.3- 51.4	65.6	23.6	10.7	Sandy Loam	13.07	7.7	0.02	+19.62	23.2	11.0	.36	4.0	7.5
	51.4- 58.8	58.1	25.0	16.8	Sandy Loam	12.34	7.3	0.06	+3.37	11.9	11.0	.88	4.0	7.1
	58.8- 65.1	44.5	32.3	23.1	Loam	15.86	7.3	0.06	+3.62	15.9	16.0	1.52	4.0	9.4
	67.1- 70.5	19.5	52.0	28.6	Silty Clay Loam	22.30	6.9	0.09	+5.62	25.3	22.0	2.43	4.0	8.8
	70.5- 98.4	41.5	40.6	17.9	Loam	16.87	7.1	0.02	+6.62	14.5	13.0	0.59	4.0	4.7
	98.4- 122.0	81.0	14.4	4.6	Loamy Sand	6.67	7.9	0.02	+7.62	6.4	5.0	0.63	4.0	10.3
	122.0- 133.6	61.8	23.9	14.4	Sandy Loam	11.28	8.0	0.03	+7.06	10.1	9.0	0.48	8.0	34.3
	133.6- 155.0	6.7	53.5	39.7	Silty Clay Loam	12.51	7.9	0.08	+9.75	24.5	23.0	2.86	4.0	4.7
2	0- 2.0	52.3	22.8	24.9	Sandy Clay Loam	11.59	4.7	0.01	-0.31	5.9	13.0	0.44	4.0	5.0
	2.0- 31.2	57.3	25.2	17.6	Sandy Loam	15.91	6.0	0.02	+5.87	12.6	12.0	0.24	4.0	5.0
	31.2- 40.8	51.0	34.5	14.5	Sandy Loam	14.39	7.7	0.04	+73.75	37.6	12.0	0.64	4.0	9.5
	40.8- 54.4	74.2	16.5	9.3	Sandy Loam	7.71	6.7	0.08	+5.00	7.4	6.0	0.55	4.0	4.6
	54.4- 79.1	16.6	54.3	29.2	Silty Clay Loam	18.61	6.9	0.10	+5.87	23.5	25.0	4.50	4.0	21.2
	83.1- 86.7	5.1	52.7	42.2	Silty Clay	20.37	7.8	0.20	+2.71	27.4	24.0	2.60	4.0	35.6
	86.7- 111.4	38.4	41.0	20.7	Loam	20.01	8.4	0.04	+10.50	16.4	13.0	0.72	4.0	24.1
	111.4- 119.2	1.6	80.3	18.1	Silt Loam	20.29	8.6	0.07	+7.51	75.0	15.0	1.35	4.0	34.4
	124.6- 127.0	4.0	51.0	45.0	Silty Clay	23.49	8.2	0.08	+10.19	103.0	24.0	2.44	4.0	18.0
3	2.0- 11.4	61.1	20.2	18.7	Sandy Loam	11.86	5.0	0.01	-0.31	0.8	8.0	0.08	4.0	3.6
	11.4- 52.6	80.7	12.1	7.3	Loamy Sand	7.35	5.5	0.01	-0.06	2.4	4.0	0.08	4.0	1.9
	52.6- 61.7	88.3	7.5	4.2	Sand	5.24	4.8	0.05	-1.06	2.2	2.0	0.16	4.0	1.5
	69.3- 70.2	11.9	58.0	30.1	Silty Clay Loam	20.22	7.4	0.11	+5.27	17.1	15.0	1.57	4.0	23.7
4	0- 2.0	60.5	20.8	18.6	Sandy Loam	7.01	4.9	0.01	-0.31	1.8	10.0	0.43	4.0	2.5
	2.0- 24.0	70.6	19.0	10.4	Sandy Loam	6.68	4.7	0.01	-0.31	0.8	3.0	0.08	4.0	1.1
	24.0- 38.9	84.5	3.1	12.4	Loamy Sand	2.91	4.7	0.01	-0.31	0.8	2.0	0.04	4.0	0.7
	38.9- 54.7	40.0	38.3	21.6	Loam	8.59	4.7	0.24	-0.53	11.2	11.0	1.03	4.0	6.6
	57.6- 64..4	26.8	48.4	24.8	Loam	8.05	4.7	0.08	-2.00	8.0	11.0	2.19	4.0	8.0
	64.4- 89.9	86.1	7.7	6.2	Loamy Sand	2.90	4.3	0.02	-0.38	1.4	2.0	0.27	4.0	1.40
	89.9- 115.3	90.5	6.3	3.2	Sand	3.64	4.3	0.02	-0.63	1.0	1.0	0.08	4.0	0.90
	115.3- 137.2	88.0	7.8	4.2	Sand	2.90	4.2	0.03	-0.94	1.2	2.0	0.27	4.0	1.50
	137.2- 138.3	19.8	49.3	31.0	Sandy Loam	11.20	4.8	0.12	-3.50	9.6	13.0	1.31	4.0	22.0
	146.4- 150.4	3.5	61.0	35.5	Silty Clay Loam	16.03	7.2	0.09	+4.16	21.6	19.0	1.76	4.0	27.0

TABLE I (Cont'd)

Core Number	Depth (ft)	Particle Size Analysis(%) Sand	Silt	Clay	Textural Class	Water Holding Capacity (%)	pH (Sat. Paste)	Total Sulfur (%)	Acid-^{a} Base Potential	Tot.Exch^b Bases	CEC^b	OC (%)	P (ppm)	K (ppm)
5	0- 4.3	78.6	13.0	8.4	Loamy Sand	3.93	6.1	0.01	+0.19	2.2	2.0	0.23	4.0	1.8
	4.3- 27.6	85.5	6.1	8.5	Loamy Sand	2.14	5.4	0.01	-0.31	0.8	3.0	0.04	4.0	1.1
	27.6- 60.1	74.1	13.7	12.2	Sandy Loam	4.01	6.6	0.01	-0.09	1.6	2.0	0.08	4.0	1.0
	66.0- 69.2	18.3	40.3	41.4	Silty Clay	12.94	5.6	0.24	-4.76	18.1	28.0	5.25	4.0	17.5
6	0- 2.2	32.7	31.7	35.6	Clay Loam	16.65	6.6	0.02	-0.63	2.0	20.0	0.24	4.0	1.8
	2.3- 25.7	38.7	38.4	23.0	Loam	14.11	5.9	0.06	-1.88	2.0	12.0	0.16	4.0	4.0
	25.5- 57.2	93.1	2.7	4.2	Sand	3.75	6.8	0.01	-0.06	1.4	1.0	0.04	4.0	0.8
	57.2- 91.9	87.9	7.8	4.2	Sand	4.86	4.7	0.06	-1.88	0.8	1.0	0.04	4.0	0.7
	91.9- 118.5	91.1	4.8	4.2	Sand	3.17	4.1	0.19	-5.94	0.8	1.0	0.12	4.0	0.6
	125.0- 128.2	9.8	63.1	27.1	Silt Loam	17.39	7.3	0.16	+0.22	14.5	17.0	1.40	4.0	30.3
7	0- 2.0	58.0	35.6	6.5	Sandy Loam	8.10	6.6	0.01	-0.31	1.8	5.0	0.43	4.0	1.9
	2.0- 10.9	57.3	19.8	22.9	Sandy Clay Loam	8.76	6.3	0.03	-0.94	1.0	13.0	0.12	4.0	2.2
	10.9- 31.0	62.4	27.1	10.5	Sandy Loam	7.86	6.3	0.02	-0.63	0.8	5.0	0.08	0.0	0.8
	31.9- 57.2	57.9	27.6	14.5	Sandy Loam	8.18	6.0	0.01	-0.31	0.8	4.0	0.11	0.0	0.5
	57.2- 78.3	72.2	16.5	11.2	Sandy Loam	7.81	6.1	0.01	-0.31	0.8	3.0	0.08	0.0	0.3
	78.3- 100.7	72.8	16.9	10.2	Sandy Loam	40.78	5.4	0.02	-0.63	1.4	2.0	0.23	0.0	0.2
	100.9- 104.0	88.3	6.5	5.2	Sand	0.65	4.9	0.75	-23.44	0.8	1.0	0.19	0.0	6.8
	110.6- 112.8	36.2	40.8	22.9	Loam	17.89	4.9	0.23	-7.19	8.2	14.0	2.34	0.0	2.1
8	0.9- 2.0	69.1	25.6	5.3	Sandy Loam	10.67	6.5	0.02	-0.63	1.6	7.0	1.07	0.0	1.2
	2.0- 17.7	61.6	11.7	26.8	Sandy Clay Loam	15.30	5.5	0.02	-0.63	1.0	7.0	0.15	0.0	1.5
	25.0- 31.7	43.5	36.0	20.5	Clay Loam	13.02	3.6	0.24	-7.50	2.2	6.0	0.65	0.0	0.2
	31.7- 59.8	85.6	7.2	7.2	Loamy Sand	8.54	5.8	0.02	-0.38	0.8	1.0	0.11	0.0	0.2
	59.8- 102.1	94.6	3.2	2.2	Sand	8.89	3.3	0.18	-5.63	0.8	1.0	0.34	0.0	12.5
	108.0- 111.8	26.2	50.9	23.0	Silt Loam	19.96	4.5	0.06	-1.13	11.0	20.0	4.23	0.0	1.4
9	0- 2.4	44.8	32.5	22.8	Loam	15.10	5.6	0.02	-0.63	1.6	7.0	0.38	0.0	2.8
	2.8- 22.1	58.9	18.2	22.9	Sandy Clay Loam	13.94	5.2	0.01	-0.31	2.83	8.0	0.04	0.0	1.0
	22.1- 39.8	88.4	3.2	8.4	Loamy Sand	5.76	5.7	0.01	+0.19	2.0	2.0	0.04	0.0	0.2
	39.8- 65.5	89.1	9.7	1.2	Sand	5.30	6.0	0.03	-0.69	0.8	1.0	0.04	0.0	0.2
	65.5- 76.3	93.0	3.8	3.2	Sand	6.03	3.6	0.23	-7.19	4.8	1.0	0.16	0.0	0.2
	84.3- 86.9	5.6	60.5	33.9	Silty Clay Loam	18.65	5.7	0.41	-8.35	21.1	22.0	2.96	0.0	15.5
10	0- 2.0	43.8	35.5	20.7	Loam	17.74	6.0	0.01	+0.68	7.1	8.0	0.80	0.0	1.7
	2.0- 27.5	56.0	25.2	18.8	Sandy Loam	14.87	5.3	0.01	-0.31	1.6	8.0	0.04	0.0	3.1
	27.5- 46.9	43.1	36.0	20.9	Loam	15.72	4.4	0.47	-10.98	0.8	8.0	0.76	0.0	0.2
	46.9- 67.3	80.7	15.1	4.2	Loamy Sand	7.85	4.0	0.05	-1.56	0.8	1.0	0.08	0.0	3.0
	67.3- 84.9	51.9	31.5	16.6	Sandy Loam	15.57	3.9	0.24	-7.50	3.6	1.0	1.54	0.0	0.9
	84.9- 112.5	78.9	14.9	6.2	Loamy Sand	13.40	3.5	0.08	-2.50	1.4	2.0	0.33	0.0	14.4
	112.5- 128.7	33.7	55.9	10.4	Silt Loam	17.44	5.7	0.32	-6.52	9.4	9.0	1.22	0.0	0.4
	136.7- 139.1	22.2	60.8	17.1	Silt Loam	18.49	7.0	0.20	+0.22	15.5	15.0	2.27	0.0	4.1

TABLE I (Concluded)

Core Number	Depth (ft)	Particle Size Analysis(%)			Textural Class	Water Holding Capacity (%)	pH (Sat. Paste)	Total Sulfur (%)	Acid-[a] Base Potential	Tot.Exch[b] Bases	CEC[b]	OC (%)	P (ppm)	K (ppm)
		Sand	Silt	Clay										
11	0- 2.3	29.3	64.2	6.5	Silt Loam	18.03	6.4	0.01	-0.31	1.2	1.0	0.28	0.0	6.6
	2.5- 12.6	27.8	53.3	18.8	Silt Loam	17.70	6.3	0.04	+0.49	9.8	9.0	0.20	0.0	7.2
	12.6- 31.6	49.2	35.3	15.5	Loam	20.26	6.6	0.30	-2.17	11.7	8.0	0.71	0.0	12.4
	31.6- 44.9	44.5	34.8	20.8	Loam	19.12	7.1	0.29	-5.08	15.8	12.0	0.84	0.0	4.5
	44.9- 49.8	18.1	47.9	34.0	Silty Clay Loam	18.29	7.7	0.19	+0.78	22.6	20.0	1.10	0.0	4.2
	49.8- 64.8	62.6	24.1	13.2	Sandy Loam	13.35	6.0	0.57	-6.86	8.6	6.0	0.66	0.0	5.8
	64.8- 79.7	65.0	23.7	11.3	Sandy Loam	12.82	25.9	0.50	+14.97	8.1	5.0	0.58	0.0	5.8
	79.7- 87.4	60.6	21.9	17.5	Sandy Loam	11.98	5.6	0.60	-14.27	8.9	7.0	0.95	0.0	26.2
	87.4- 97.5	6.0	47.5	46.5	Silty Clay	13.41	7.6	0.28	-1.04	26.1	33.0	3.70	0.0	9.6

[a] Tons $CaCO_3$ Equivalent/1,000 Tons

[b] Meq/100g

Source: SWEPCO Laboratory Analyses

TABLE 2

SELECTED CHEMICAL PROPERTIES OF ELEVEN
OVERBURDEN CORES

PAUL WEIR COMPANY 1979

Core Number	Depth (ft)	Potential Acidity	Neutralization Potential	Net Acidity - Alkalinity	Extractable Bases			
					Na	K	Ca	Mg
		(tons $CaCO_3$ equiv/1,000 tons)			(meq/100g)			
1	0 - 4.5	0.31	0.0	-0.31	1.6	0.2	2.5	1.4
	4.5 - 11.1	0.94	0.0	-0.94	2.0	0.4	3.0	8.5
	11.1 - 23.2	1.88	1.74	-0.38	1.0	0.2	3.3	5.3
	23.2 - 28.2	5.63	10.2	+4.37	0.8	0.61	9.5	8.7
	28.2 - 33.3	7.81	11.19	+3.91	0.8	0.6	13.0	8.7
	33.3 - 51.4	0.63	20.4	+19.62	0.6	0.2	17.5	4.9
	51.4 - 58.8	1.88	5.47	+3.37	0.1	0.2	7.9	3.7
	58.8 - 65.1	1.88	5.72	+3.62	0.6	0.4	10.0	4.9
	67.1 - 70.5	2.81	6.47	+5.62	0.8	0.4	17.0	7.1
	70.5 - 98.4	0.63	7.46	+6.62	0.8	0.4	9.6	3.7
	98.4 - 122.0	0.63	8.46	+7.62	0.8	0.2	4.2	1.2
	122.0 - 133.6	0.94	8.21	+7.06	1.8	0.4	6.3	1.6
	133.6 - 155.0	2.5	12.44	+9.75	6.6	1.0	12.6	4.3
2	0 - 2.0	0.31	0.0	-0.31	0.8	0.2	2.7	2.2
	2.0 - 31.2	0.63	6.72	+5.87	0.8	0.2	5.5	6.1
	31.2 - 40.8	1.25	75.12	+73.75	0.6	0.2	34.1	2.7
	40.8 - 54.4	2.5	7.71	+5.0	0.6	0.2	5.0	1.6
	54.4 - 79.1	3.13	9.2	+5.87	3.0	0.4	14.1	6.0
	83.1 - 86.7	6.25	8.96	+2.71	6.5	0.1	14.9	5.9
	86.7 - 111.4	1.25	11.94	+10.50	6.3	0.4	7.2	2.5
	111.4 - 119.2	2.19	9.7	+7.51	63.2	1.1	8.0	2.7
	124.6 - 127.0	2.5	12.69	+10.19	89.6	1.3	9.0	3.1
3	2.0 - 11.4	0.31	0.0	-0.31	0.2	0.2	0.2	0.2
	11.4 - 52.6	0.31	0.25	-0.06	0.2	0.2	1.0	1.0
	52.6 - 61.7	1.56	0.50	-1.06	0.2	0.2	1.2	0.6
	69.3 - 70.2	3.44	8.71	+5.27	2.9	0.8	7.2	6.2
4	0 - 2.0	0.31	0.0	-0.31	0.2	0.2	0.8	0.6
	2.0 - 24.0	0.31	0.0	-0.31	0.2	0.2	0.2	0.2
	24.0 - 38.9	0.31	0.0	-0.31	0.2	0.2	0.2	0.2
	38.9 - 54.7	7.5	6.97	-0.53	0.2	0.4	4.9	5.7
	57.6 - 64.4	2.5	0.5	-2.0	0.2	0.4	3.7	3.7
	64.4 - 89.9	0.63	0.25	-0.38	0.2	0.2	0.4	0.6
	89.9 - 115.3	0.63	0.0	-0.63	0.2	0.2	0.2	0.4
	115.3 - 137.2	0.94	0.0	-0.94	0.2	0.2	0.4	0.4
	137.2 - 138.3	3.75	0.25	-3.5	1.6	0.2	3.7	4.1
	146.4 - 150.4	2.81	6.97	+4.16	4.9	1.4	8.5	6.8

TABLE 2 (Cont'd)

Core Number	Depth (ft)	Potential Acidity	Neutralization Potential	Net Acidity - Alkalinity	Extractable Bases Na	K	Ca	Mg
		(tons $CaCO_3$ equiv/1,000 tons)			(meq/100g)			
5	0.0 - 4.3	0.31	0.5	+0.19	0.2	0.2	1.4	0.4
	4.3 - 27.6	0.31	0.0	-0.31	0.2	0.2	0.2	0.2
	27.6 - 60.1	0.09	0.0	-0.09	0.2	0.2	0.8	0.4
	66.0 - 69.2	7.5	2.74	-4.76	1.3	0.4	8.7	7.7
6	0 - 2.2	0.63	0.0	-0.63	0.2	0.2	0.2	1.4
	2.3 - 25.7	1.88	0.0	-1.88	0.2	0.2	0.8	0.8
	25.5 - 57.2	0.31	0.25	-0.06	0.2	0.2	0.8	0.2
	57.2 - 91.9	1.88	0.0	-1.88	0.2	0.2	0.2	0.2
	91.9 - 118.5	5.94	0.0	-5.94	0.2	0.2	0.2	0.2
	125.0 - 128.2	5.0	5.22	+0.22	2.7	1.0	5.7	5.1
7	0 - 2.0	0.31	0.0	-0.31	0.2	0.2	0.8	0.6
	2.0 - 10.9	0.94	0.0	-0.94	0.2	0.2	0.2	0.4
	10.9 - 31.0	0.63	0.0	-0.63	0.2	0.2	0.2	0.2
	31.9 - 57.2	0.31	0.0	-0.31	0.2	0.2	0.2	0.2
	57.2 - 78.3	0.31	0.0	-0.31	0.2	0.2	0.2	0.2
	78.3 - 100.7	0.63	0.0	-0.63	0.2	0.2	0.6	0.4
	100.9 - 104.0	23.44	0.0	-23.44	0.2	0.2	0.2	0.2
	110.6 - 112.8	7.19	0.0	-7.19	0.4	0.4	3.7	3.7
8	0.9 - 2.0	0.63	0.0	-0.63	0.2	0.2	0.8	0.4
	2.0 - 17.7	0.63	0.0	-0.63	0.2	0.2	0.2	0.4
	25.2 - 31.7	7.5	0.0	-7.5	0.2	0.2	1.0	0.8
	31.7 - 59.8	0.63	0.25	-0.38	0.2	0.2	0.2	0.2
	59.8 - 102.1	5.63	0.0	-5.63	0.2	0.2	0.2	0.2
	108.0 - 111.8	1.88	0.75	-1.13	0.8	0.4	4.7	5.1
9	0 - 2.4	0.63	0.0	-0.63	0.2	0.2	0.2	1.0
	2.8 - 22.1	0.31	0.0	-0.31	1.0	0.2	0.2	1.43
	22.1 - 39.8	0.31	0.5	+0.19	0.6	0.2	0.6	0.6
	39.8 - 65.5	0.94	0.25	-0.69	0.2	0.2	0.2	0.2
	65.5 - 76.3	7.19	0.0	-7.19	0.2	0.2	4.2	0.2
	84.3 - 86.9	12.81	4.46	-8.35	3.1	0.6	10.0	7.4
10	0 - 2.0	0.31	0.99	+0.68	0.2	0.4	5.1	1.4
	2.0 - 27.5	0.31	0.0	-0.31	0.2	0.2	0.2	1.0
	27.5 - 46.9	14.69	3.71	-10.98	0.2	0.2	0.2	0.2
	46.9 - 67.3	1.56	0.0	-1.56	0.2	0.2	0.2	0.2
	67.3 - 84.9	7.5	0.0	-7.5	0.2	0.2	1.6	1.6
	84.9 - 112.5	2.5	0.0	-2.5	0.2	0.2	0.4	0.6
	112.5 - 128.7	10.0	3.48	-6.52	1.6	0.4	4.2	3.2
	136.7 - 139.1	6.25	6.47	+0.22	3.7	0.4	6.2	5.2

TABLE 2 (Concluded)

Core Number	Depth (ft)	Potential Acidity	Neutralization Potential	Net Acidity - Alkalinity	Extractable Bases			
					Na	K	Ca	Mg
		(tons $CaCO_3$ equiv/1,000 tons)			(meq/100g)			
11	0 - 2.5	0.31	0.0	-0.31	0.2	0.2	0.4	0.4
	2.5 - 12.6	1.25	1.74	+0.49	1.4	0.2	4.5	3.7
	7.6 - 31.6	9.38	7.21	-2.17	0.6	0.2	7.8	3.1
	31.6 - 44.9	9.06	3.98	-5.08	0.6	0.4	11.1	3.7
	44.9 - 49.8	5.94	6.72	+0.78	0.8	0.4	15.5	5.9
	49.8 - 64.8	17.81	10.95	-6.86	0.8	0.2	5.0	2.6
	64.8 - 79.7	15.63	30.60	+14.97	0.6	0.2	5.1	2.2
	79.7 - 87.4	18.75	4.48	-14.27	0.8	0.2	5.3	2.6
	95.3 - 97.5	8.75	7.71	-1.04	5.2	0.6	13.4	6.9

Source: SWEPCO laboratory analysis.

TABLE 3

CHEMICAL PROPERTIES OF ELEVEN OVERBURDEN CORES
PAUL WEIR COMPANY 1979

		Mg/l																	
Core Number	Depth (ft)	As	Be	B	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	V	Zn	Fe[a]	Acidity[b]	Al[b]
1	0- 4.5	2	1	1	3	68	21	44,900	36	150	.6	10	42	.6	130	69	327	14.8	5.4
	4.5- 11.1	1	2	1	2	63	23	30,800	27	80	.4	10	33	1.5	130	160	35	15.0	8.3
	11.1- 23.2	1	1	1	2	61	12	12,100	18	80	.4	10	33	1.4	40	40	100	0.4	8.1
	23.2- 28.2	1.5	3	1	3	99	30	32,200	36	590	2.2	10	62	.4	120	112	78	0.0	0.0
	28.2- 33.3	1	2	2	4	86	31	30,900	18	590	.6	10	47	1.6	130	200	74	0.0	0.0
	33.3- 51.4	1	1	1	3	47	22	19,340	18	320	.3	10	23	.5	70	78	109	0.0	0.0
	51.4- 58.8	2.5	1	1	2	43	20	10,440	18	130	.4	10	23	1.4	60	107	82	0.0	0.0
	58.8- 65.1	1	1	1	4	56	22	13,750	27	170	.5	10	31	.4	60	70	63	0.0	0.0
	67.1- 70.5	1	2	3	4	68	32	13,630	18	80	.5	10	34	1.6	160	108	86	0.0	0.0
	70.5- 98.4	1	1	1	3	73	22	17,040	9	220	.5	10	39	1.2	80	150	108	0.0	0.0
	98.4- 122.0	1	1	1	2	45	14	11,550	9	140	.3	10	18	.7	30	44	110	0.0	0.0
	122.0- 133.6	1	1	1	3	50	20	15,400	18	210	.3	10	32	.7	60	69	126	0.0	0.0
	133.6- 155.0	1	2	3	4	77	33	26,900	27	420	.5	10	45	.9	140	102	80	0.0	0.0
2	0- 2.0	1	1	1	2	33	23	16,470	18	50	.3	10	12	.8	40	47	97	10.6	2.1
	2.0- 31.2	1	2	1	2	52	23	27,300	18	250	.4	10	44	.6	60	86	87	0.0	0.1
	31.2- 40.8	1	1	1	3	56	21	42,600	27	720	.4	10	48	1.2	100	85	97	0.0	0.0
	40.8- 54.4	1.5	1	1	2	29	13	21,100	18	460	.4	10	28	.6	40	40	146	0.0	0.1
	54.4- 79.1	1	1.7	6	3.4	56	35.6	17,356	22.9	203.4	4.2	10	35.6	.6	119	95.8	74	0.0	0.0
	83.1- 86.7	1	2	6	3	95	41	18,340	36	90	.3	10	68	1.3	180	116	73	0.0	0.0
	86.7- 111.4	1.5	1	2	3	87	22	24,100	27	500	.6	10	49	.7	100	91	56	0.0	0.0
	111.4- 119.2	1	2	3	3	93	32	26,700	36	440	.4	10	62	.8	150	113	37	0.0	0.0
	124.6- 127.0	1	2	2	3	85	30	14,630	45	70	.4	10	45	1.0	160	102	59	0.0	0.0
3	2.0- 11.4	1	1	1	3	34	21	27,600	18	50	.4	10	33	.7	50	60	188	8.1	4.2
	11.4- 52.6	1	1	1	1	31	21	26,700	18	70	.9	10	31	.7	30	51	117	24.0	0.1
	52.6 -61.7	1	1	1	2	18	12	2,860	9	20	.4	10	15	.8	10	34	151	1.0	0.1
	69.3- 70.2	1	2	1	3	89	33	16,270	45	90	.4	10	54	.9	140	110	90	0.0	0.0
4	0- 2.0	1.5	1	1	2	60	22	30,600	27	80	.4	10	22	1.1	70	38	119	12.1	1.9
	2.0- 24.0	1	1	1	1	22	13	2,569	18	10	.4	10	18	.6	20	42	101	1.6	1.5
	24.0- 38.9	1	1	1	1	26	24	5,740	9	20	.3	10	23	.6	20	46	220	1.6	0.7
	38.9- 54.7	1	2	1	2	84	32	30,100	36	500	1.1	10	55	.7	100	150	90	7.3	0.6
	57.6- 64.4	1	1	2	2	53	20	6,060	36	50	1.2	10	73	.8	70	75	124	8.1	0.7

TABLE 3 (Cont'd)

Core Number	Depth (ft)	Mg/l															Fe^a	Acidity^b	Al^b
		As	Be	B	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	V	Zn			
4	64.4- 89.9	1	1	1	2	17	11	2,145	9	30	.5	10	19	.6	10	40	51	1.0	0.2
	89.9- 115.3	1.5	1	1	2	13	12	1,415	18	20	.4	10	16	.6	20	26	57	2.4	0.1
	115.3- 137.2	4	1	1	2	16	12	1,282	9	20	.4	10	20	.2	20	35	58	1.0	0.2
	137.2- 138.3	1	1	1	3	70	23	6,360	36	40	.9	10	40	.6	130	100	101	6.5	0.1
	146.4- 150.4	1	2	2	3	92	31	17,030	36	110	1.1	10	56	1.0	170	104	96	0.0	0.0
5	0- 4.3	1	1	1	1	42	32	21,590	18	140	.3	10	32	.7	30	28	198	0.0	0.1
	4.3- 27.6	1	1	1	1	13	10	4,500	18	10	.1	10	10	.7	20	20	32	3.2	1.4
	27.6- 60.1	1	1	1	1	19	11	3,111	18	10	.2	10	9	.7	30	15	19	0.0	0.3
	66.0- 69.2	1	2	6	3	66	32	11,500	36	70	.3	10	60	.6	150	110	110	17.9	1.7
6	0- 2.2	1	2	1	2	47	22	30,800	18	90	.1	10	28	1.4	150	50	137	0.0	5.6
	2.3- 25.7	1	1	1	3	51	23	46,000	18	40	.3	10	24	.8	100	81	219	12.3	6.9
	25.5- 57.2	1	1	1	2	5	11	2,324	9	30	.1	10	7	1.0	10	18	22	0.0	0.1
	57.2- 91.9	1	1	1	1	5	12	2,629	9	10	.1	10	6	.6	10	23	128	3.2	0.2
	91.9- 118.5	1	1	1	2	5	13	2,225	9	10	.2	10	10	.6	10	20	66	1.6	0.7
	125.0- 128.2	1	1	2	3	78	31	15,780	18	100	.1	10	48	.9	140	114	73	0.0	0.0
7	0- 2.0	1	1	1	3	43	14	67,700	45	180	.1	10	23	1.4	110	45	147	0.0	0.6
	2.0- 10.9	1	1	1	3	36	21	149,300	64	250	.2	20	33	1.1	190	107	73	0.0	3.5
	10.9- 31.0	1	1	1	1	25	13	15,010	45	20	.2	10	12	.7	60	20	61	0.0	3.2
	31.9- 57.2	1	1	1	2	22	12	4,058	27	10	.2	10	8	.6	70	12	69	0.0	2.0
	57.2- 78.3	1	1	1	2	9	10	2,972	18	10	.2	10	7	.7	50	8	63	0.0	0.6
	78.3- 100.7	1	1	1	1	26	13	5,280	9	10	.3	10	12	.8	40	22	79	2.4	0.8
	100.9- 104.0	1	1	1	1	6	10	11,810	9	20	.1	10	12	.3	20	31	156	1.6	1.0
	110.6- 112.8	1	1	3	2	40	20	6,100	9	40	.2	10	42	1.2	90	103	108	13.9	0.9
8	0.9- 2.0	1	3	1	3	64	21	151,400	36	220	.2	10	30	1.2	150	92	151	0.0	0.7
	2.0- 17.7	1	1	1	2	21	13	29,700	9	20	.1	10	13	.8	60	31	81	8.1	4.7
	25.2- 31.7	1	1	1	2	53	23	4,130	36	40	.2	10	30	.2	90	160	136	5.6	0.9
	31.7- 59.8	1.5	1	1	3	5	11	4,810	100	20	.2	10	9	.7	20	17	45	2.4	0.1
	59.8- 102.1	2.5	1	1	2	5	11	2,722	27	10	.1	10	7	.2	20	28	115	4.0	0.3
	108.0- 111.8	2.5	1	2	3	59	33	9,220	45	60	1.0	10	52	1.0	180	111	105	15.6	2.3

TABLE 3 (Concluded)

		Mg/l																	
Core Number	Depth (ft)	As	Be	B	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	V	Zn	Fe^a	Acidity^b	Al^b
9	0- 2.4	1	1	1	4	43	22	43,200	27	160	.1	10	21	.8	90	41	78	8.9	3.4
	2.8- 22.1	1	1	1	3	40	21	36,300	27	140	.1	10	20	.2	80	58	21	10.6	5.4
	22.1- 39.8	1	1	1	2	6	14	13,660	18	190	.2	10	12	.7	40	52	44	1.6	0.1
	39.8- 65.5	1.5	1	1	1	5	14	2,400	9	10	.4	10	5	.6	10	12	156	0.0	0.1
	65.5- 76.3	1	1	1	2	5	11	3,045	18	10	.1	10	10	1.0	10	24	79	3.2	0.5
	84.3- 86.9	1	1	6	3	76	43	15,140	36	90	.3	10	47	1.0	180	111	116	11.7	0.3
10	0- 2.0	1	1	1	3	40	21	13,850	18	70	.3	10	19	11.0	60	35	72	0.0	0.1
	2.0- 27.5	1	1	1	3	30	22	36,200	27	40	.2	10	18	.7	90	35	106	6.5	2.7
	27.5- 46.9	3.5	1	1	3	64	20	31,600	27	170	.3	10	40	.6	160	180	461	10.7	4.0
	46.9- 67.3	1	1	1	2	5	11	2,405	9	10	.1	10	8	.6	10	17	168	1.6	0.5
	67.3- 84.9	1	1	2	2	22	21	4,475	27	30	.2	10	20	.6	70	42	130	8.1	1.0
	84.9- 112.5	1	1	1	1	42	20	6,310	10	50	.1	10	16	1.2	40	28	428	6.4	0.7
	112.5- 128.7	1.5	1	2	1	51	20	8,950	18	80	.2	10	26	1.4	100	60	109	6.4	0.2
	136.7- 139.1	1	1	3	3	59	31	14,700	27	100	.2	10	45	1.2	140	99	97	0.0	0.0
11	0- 2.5	1	1	1	2	29	10	9,140	18	40	.1	10	14	.7	60	30	109	0.0	0.6
	2.5- 12.6	2.5	1	1	2	46	20	16,350	27	130	.2	10	25	.1	70	56	90	0.0	0.2
	7.6- 31.6	4	1	1	2	39	21	20,550	18	260	.3	10	18	.6	70	62	83	0.0	0.1
	31.6- 44.9	1	1	1	1	38	11	14,810	18	230	.2	10	16	.7	80	60	90	0.0	0.0
	44.9- 49.8	1.5	1	1	1	49	20	23,900	27	510	.1	10	27	.6	120	83	83	0.0	0.0
	49.8- 64.8	1	1	1	2	33	10	36,000	27	40	.2	10	28	.6	70	93	109	0.0	0.4
	64.8- 79.7	2.5	1	1	1	22	11	19,370	27	140	.3	10	22	1.1	20	69	125	1.0	0.1
	79.7- 87.4	1	1	2	3	33	20	26,700	27	150	.2	10	34	.7	60	170	231	9.8	1.9
	95.3- 97.5	1	1	6	3	62	30	15,900	27	90	.2	10	44	1.7	130	110	108	0.0	0.0

[a] Extractable Fe in ppm

[b] meq/100g

Source: SWEPCO Laboratory Analyses

TABLE 4

CHEMICAL ANALYSES OF ELEVEN OVERBURDEN CORES

PAUL WEIR COMPANY 1979

Core Number	Depth (ft)	Na	K	Ca	Total Mg	Fe[a]	Cu	Mn	Zn
					(meq/100g)				
1	12.0' - 14.0'	1.83	0.24	1.89	5.58	53	13	120	86
	43.0' - 45.0'	0.39	0.26	22.44	4.55	47	17	1100	106
	48.0' - 50.0'	0.30	0.18	8.07	3.82	44	10	425	98
	64.0' - 66.0'	0.57	0.25	12.53	4.72	133	11	75	81
	78.0' - 80.0'	0.37	0.18	4.11	1.68	44	8	83	88
	101.0' - 103.0'	0.88	0.26	4.93	1.95	37	8	225	82
	117.0' - 119.0'	0.95	0.20	4.20	1.56	50	8	225	98
	130.0' - 132.0'	1.86	0.25	5.57	1.77	59	10	200	113
	138.0' - 140.0'	6.78	0.67	12.16	4.59	140	19	600	147
	151.0' - 153.0'	8.04	0.59	11.95	3.93	114	25	700	145
	162.0' - 164.0'	14.45	0.54	12.01	4.28	76	23	113	116
2	7.0' - 9.0'	0.03	0.18	6.21	8.61	17	10	300	121
	24.0' - 26.0'	0.18	0.21	5.38	3.48	77	10	138	142
	48.4' - 50.4'	0.47	0.18	6.54	3.41	484	13	2813	117
	55.0' - 57.0'	1.28	0.33	6.95	3.11	78	15	90	104
	59.0' - 61.0'	6.99	0.67	13.95	4.59	108	15	80	98
	73.0' - 75.0'	4.06	0.56	14.11	6.23	135	19	725	139
3	13.4' - 15.4'	0.11	0.10	0.81	0.35	485	13	225	117
	25.0' - 27.0'	0.11	0.07	0.70	0.97	11	4	23	63
	37.5' - 39.5'	0.11	0.09	1.03	1.47	19	6	23	72
	47.0' - 49.0'	0.07	0.10	0.98	1.55	12	8	20	66
	69.0' - 71.0'	3.53	0.56	8.77	10.82	159	26	63	136
4	5.0' - 7.0'	0.02	0.02	0.06	0.06	4	7	23	44
	18.0' - 20.0'	0.03	0.03	0.06	0.02	13	5	18	49
	120.0' - 122.0'	0.09	0.05	0.22	0.46	43	4	20	66
	33.0' - 35.0'	0.03	0.02	0.06	0.06	8	4	5	54
	49.0' - 51.0'	0.19	0.32	5.87	6.11	136	14	650	178
	68.0' - 70.0'	0.08	0.05	0.62	0.80	54	5	53	60
	84.0' - 86.0'	0.05	0.08	0.42	0.65	54	4	25	60
	93.2' - 95.2'	0.05	0.03	0.22	0.26	21	20	33	66
	109.0' - 110.0'	0.10	0.04	0.18	0.34	27	4	13	54
	133.7' -	0.29	0.12	0.55	0.91	71	5	20	72
5	32.0' - 34.0'	0.04	0.02	0.02	0.04	7	4	13	49
	39.0' - 41.0'	0.11	0.05	0.71	0.71	13	7	20	59
	52.0' - 54.0'	0.21	0.07	0.62	0.24	12	5	19	47
	6.0' - 8.0'	0.08	0.19	0.02	0.60	259	10	35	77
6	20.0' - 22.0'	0.12	0.10	0.57	1.22	523	13	100	125
	29.0' - 31.0'	0.05	0.03	0.08	0.22	8	3	140	43
	42.0' - 44.0'	0.10	0.03	0.14	0.30	14	4	13	53
	52.0' - 54.0'	0.08	0.04	0.20	0.44	22	6	13	46
	59.0' - 61.0'	0.22	0.05	0.28	0.62	14	18	13	64
	68.0' - 70.0'	0.17	0.03	0.20	0.20	13	5	13	50
	82.0' - 84.0'	0.19	0.03	0.18	0.22	46	5	23	46
	97.0' - 99.0'	0.02	0.02	0.06	0.10	253	4	15	50
	111.0' - 113.0'	0.02	0.02	0.12	0.14	19	3	15	51

TABLE 4 (Concluded)

Core Number	Depth (ft)	Na	K	Ca	Total Mg	Fe[a]	Cu	Mn	Zn
					(meq/100g)				
7	25.0' - 27.0'	0.05	0.07	0.02	0.02	9	6	20	51
	49.0' - 51.0'	0.02	0.03	0.02	0.02	11	9	20	50
	73.0' - 75.0'	0.02	0.02	0.16	0.28	5	20	10	71
	83.0' - 83.0'	0.04	0.05	1.47	0.92	12	9	20	61
	96.0' - 98.0'	0.02	0.02	0.18	0.16	67	4	15	54
8	14.0' - 16.0'	0.18	0.12	0.18	0.33	504	15	58	89
	24.0' - 26.0'	0.02	0.02	0.10	1.28	42	11	75	207
	37.0' - 39.0'	0.04	0.02	0.18	0.20	8	3	20	48
	53.0' - 55.0'	0.02	0.02	0.06	0.12	10	4	14	47
	64.0' - 66.0'	0.03	0.02	0.14	0.14	27	6	8	47
	73.0' - 75.0'	0.02	0.02	0.12	0.12	7	3	8	57
	86.0' - 88.0'	0.02	0.02	0.08	0.08	187	4	13	50
	95.0' - 97.0'	0.02	0.02	0.08	0.10	216	9	15	53
9	33.6' - 35.6'	0.37	0.03	0.35	0.47	13	17	38	54
	44.0' - 46.0'	0.18	0.02	0.54	0.20	5	31	23	58
	59.0' - 61.0'	0.17	0.02	0.20	0.14	20	5	10	40
	73.0' - 75.0'	0.02	0.02	0.18	0.26	23	4	13	73
10	5.0' - 7.0'	0.03	0.06	0.06	1.18	43	21	28	96
	20.0' - 22.0'	0.03	0.13	0.16	0.63	103	8	15	58
	40.0' - 42.2'	0.03	0.08	2.83	0.27	33	11	375	390
	50.0' - 52.0'	0.02	0.02	0.12	0.06	27	5	13	47
	61.0' - 63.0'	0.02	0.02	0.18	0.26	45	5	18	55
	65.5' - 67.5'	0.02	0.02	0.06	0.12	20	4	13	69
	80.0' - 82.0'	0.03	0.06	0.46	0.69	79	5	28	66
	89.0' - 91.0'	0.02	0.02	0.34	0.44	166	5	25	69
	105.0' - 107.0'	0.02	0.02	0.40	1.07	143	9	33	66
	114.0' - 116.0'	1.24	0.12	2.17	1.17	130	13	158	85
11	41.0' - 43.0'	0.78	0.45	14.75	6.11	94	14	575	125
	74.7' - 76.7'	0.95	0.21	6.22	3.54	414	10	413	149

[a] Extractable Fe in ppm.

Source: SWEPCO Laboratory Analyses.

TABLE 5

PHYSCIAL AND CHEMICAL PROPERTIES OF SEVEN OVERBURDEN CORES
MC CLELLAND ENGINEERS 1980

Core Number	Depth (ft)	Particle Size Analysis (%) Sand	Silt	Clay	Textural Class	Water Holding Capacity (%)[d]	pH (Sat. Paste)	Total Sulphur (%)	Acid-Base Potential[b]	Tot. Exch. Bases (meq/100g)	CEC[a] (meq/100g)	OC (%)	P (ppm)	K (ppm)
1	5-10.5	53.9	18.7	27.4	Sandy Loam	--	4.4	0.01	-0.31	0.45	--	0.13	1.0	--
	10.5-16.0	11.0	41.7	47.4	Silty Clay	--	3.9	0.01	-0.31	13.95	--	0.40	1.0	--
	16.0-23.0	5.3	35.0	59.1	Clay	--	4.3	0.16	+1.83	24.17	--	1.61	1.5	--
	23.0-31.5	35.4	51.2	13.4	Silt Loam	--	6.3	0.02	+8.97	5.39	--	1.21	2.5	--
	31.5-40.0	11.0	73.4	15.6	Silt Loam	--	7.0	0.09	+6.55	6.33	--	1.34	5.5	--
	40.0-43.5	56.4	25.8	17.8	Sandy Loam	--	3.6	0.33	-5.63	6.90	--	1.34	1.0	--
	43.5-51.5	85.5	9.9	4.6	Sand	--	5.4	0.02	-0.61	1.32	--	0.54	1.0	--
	51.5-58.0	85.5	9.9	4.6	Sand	--	3.6	0.46	+0.25	15.05	--	1.74	1.0	--
	58.0-62.0	59.2	25.0	15.8	Sandy Loam	--	3.3	0.23	-2.81	13.44	--	1.34	1.0	--
	62.0-68.0	58.1	26.6	15.3	Sandy Loam	--	4.1	0.17	-4.05	9.88	--	1.34	1.0	--
	68.0-77.0	42.0	39.8	18.2	Loam	--	6.5	0.09	+7.56	11.46	--	1.07	2.0	--
	77.0-79.5	19.1	46.4	34.5	Silty Clay Loam	--	6.3	0.60	+11.25	22.62	--	3.15	1.5	--
	79.5-83.0	49.2	29.2	21.6	Sandy Clay Loam	--	3.1	0.89	+3.30	15.73	--	2.14	1.0	--
	83.0-91.0	5.1	65.2	29.7	Silty Clay Loam	--	5.7	0.32	+27.37	12.63	--	1.88	2.5	--
	91.0-97.0	20.0	52.3	27.7	Silt Loam	--	5.3	0.36	+16.00	16.24	--	2.28	1.0	--
	97.0-101.0	15.9	49.5	34.6	Clay Loam	--	3.6	0.89	-14.48	20.26	--	3.35	1.0	--
	101.0-106.0	56.5	26.1	17.5	Sandy Loam	--	3.1	0.28	-2.50	6.33	--	1.07	1.0	--
	106.0-115.0	60.0	26.7	13.3	Sandy Loam	--	3.7	0.32	+10.25	4.89	--	1.61	1.0	--
	115.0-121.0	4.0	61.6	34.4	Silty Clay Loam	--	6.2	0.09	+3.77	19.93	--	5.23	1.0	--
	121.0-127.5	17.3	55.5	27.2	Silt Loam	--	6.0	0.16	+5.12	25.42	--	9.38	3.5	--
	127.5-132.0	4.6	50.4	45.0	Silty Clay	--	7.4	0.07	+9.69	24.62	--	2.95	1.0	--
2	2.0-9.0	29.7	35.8	34.6	Clay Loam	--	4.4	0.02	-0.63	7.92	--	1.07	1.0	--
	9.0-17.0	3.2	64.7	32.1	Silty Clay Loam	--	7.1	0.07	+11.97	18.52	--	13.40	4.5	--
	17.0-27.0	40.1	35.5	24.4	Clay Loam	--	7.1	0.14	+3.12	18.79	--	0.67	1.0	--
	27.0-37.0	59.5	25.6	14.9	Sandy Loam	--	7.1	0.07	+3.38	12.15	--	0.84	4.5	--
	37.0-43.0	79.5	12.9	7.6	Loamy Sand	--	7.9	0.02	+30.70	8.11	--	0.67	6.0	--
	43.0-51.0	59.4	26.8	13.7	Sandy Loam	--	7.4	0.49	+1.68	10.82	--	1.07	1.5	--
	51.0-58.0	18.3	74.4	7.3	Silt Loam	--	4.0	0.24	-3.44	10.47	--	0.67	1.0	--
	58.0-67.2	68.4	6.9	38.5	Sandy Clay	--	3.6	0.75	-12.03	20.45	--	2.68	1.0	--
	67.2-76.0	4.9	62.8	32.3	Silty Clay Loam	--	4.4	0.71	-5.19	28.02	--	13.40	1.5	--
	76.0-85.0	71.5	25.4	3.1	Sandy Loam	--	2.9	0.25	-2.50	5.85	--	0.67	1.0	--
	85.0-90.5	58.0	35.8	7.3	Sandy Loam	--	4.0	0.14	-4.38	3.73	--	1.07	1.0	--
	90.5-98.5	56.1	25.7	17.4	Sandy Loam	--	5.6	0.40	+28.41	10.74	--	2.01	1.0	--
	98.5-107.5	45.4	32.4	22.2	Loam	--	5.4	0.38	-0.12	27.29	--	7.58	1.0	--
	107.5-112.0	4.9	69.3	25.9	Silt Loam	--	6.6	0.07	+5.90	17.20	--	13.40	1.0	--
	112.0-121.0	58.9	31.9	9.2	Sandy Loam	--	8.1	0.02	+25.65	8.36	--	0.89	1.0	--
	121.0-127.0	37.1	41.4	21.5	Loam	--	6.9	0.04	+7.09	10.93	--	1.07	1.0	--
	127.0-133.5	26.1	56.1	17.8	Silt Loam	--	7.3	0.02	+8.86	11.15	--	1.34	1.0	--
	133.5-140.0	15.9	56.4	27.8	Silt Loam	--	8.1	0.04	-1.25	15.54	--	1.47	1.0	--

TABLE 5 (Cont'd)

Core Number	Depth (ft)	Particle Size Analysis (%)			Textural Class	Water Holding Capacity (%)[a]	pH (Sat. Paste)	Total Sulphur (%)	Acid-Base Potential[b]	Tot. Exch. Bases (meq/100g)	CEC[a] (meq/100g)	OC (%)	P (ppm)	K (ppm)
		Sand	Silt	Clay										
3	1.0-11.0	78.0	11.5	10.6	Sandy Loam	--	4.9	0.01	-0.31	1.40	--	0.01	2.0	--
	11.0-19.0	81.6	14.8	3.6	Loamy Sand	--	5.1	0.01	-0.31	0.14	--	0.13	1.0	--
	19.0-28.0	82.5	9.9	7.6	Loamy Sand	--	4.9	0.01	-0.29	0.13	--	0.01	1.0	--
	28.0-37.0	91.2	6.2	2.6	Sand	--	5.5	0.01	-0.31	0.21	--	0.01	1.0	--
	37.0-45.5	25.7	63.2	11.1	Silt Loam	--	5.4	0.01	-0.31	0.17	--	0.01	2.5	--
	45.5-50.0	84.8	4.5	10.7	Loamy Sand	--	2.4	0.35	-3.75	0.17	--	2.81	1.0	--
	50.0-61.0	90.6	1.8	7.6	Sand	--	2.4	0.81	-18.13	2.18	--	2.01	1.0	--
	60.7-70.0	8.3	72.1	19.6	Silt Loam	--	5.2	0.35	-0.45	22.74	--	5.49	1.0	--
4	0.5-8.0	19.2	30.8	50.0	Clay	--	4.6	0.02	-0.63	1.93	--	10.21	1.0	--
	8.0-17.5	10.5	45.7	43.8	Silty Clay	--	4.1	0.02	-0.63	4.24	--	0.13	1.0	--
	17.5-27.5	34.3	26.7	38.9	Clay Loam	--	3.9	1.09	-11.88	6.70	--	1.21	1.0	--
	27.5-36.0	27.1	47.1	25.9	Loam	--	3.2	1.14	-4.88	17.02	--	2.81	1.0	--
	36.0-45.5	9.6	77.2	13.3	Silt Loam	--	4.7	0.02	-0.13	2.36	--	0.01	1.0	--
	45.5-49.0	68.6	24.4	7.2	Sandy Loam	--	4.7	0.02	-0.63	0.52	--	0.01	1.0	--
	49.0-56.0	51.5	29.0	19.5	Loam	--	3.3	0.68	+10.01	4.45	--	1.61	2.5	--
	56.0-65.5	31.0	51.7	17.3	Silt Loam	--	3.4	0.14	-1.11	2.96	--	3.22	1.0	--
	65.5-72.5	70.3	24.5	5.21	Sandy Loam	--	2.5	0.12	-3.75	1.41	--	0.54	1.0	--
	72.5-81.5	79.7	13.7	6.6	Loamy Sand	--	2.4	0.07	-2.19	0.24	--	0.54	1.0	--
	81.5-90.0	88.3	8.2	3.6	Sand	--	2.6	0.12	-3.75	0.20	--	0.13	1.0	--
	90.0-99.5	89.0	6.4	4.6	Sand	--	2.7	0.02	-0.63	0.21	--	0.28	1.0	--
	99.5-109.5	89.7	5.7	4.6	Sand	--	3.4	0.01	-0.31	0.42	--	0.13	1.0	--
	109.5-119.5	90.4	6.0	3.6	Sand	--	2.4	0.02	-0.63	0.52	--	1.10	1.0	--
	119.5-129.5	88.9	7.6	3.6	Sand	--	3.4	0.02	-0.63	0.50	--	1.10	1.0	--
	136.0-137.0	13.8	60.4	25.8	Silt Loam	--	3.3	0.21	-2.19	5.23	--	5.24	1.0	--
5	0.5-8.5	55.0	25.6	19.5	Sandy Loam	--	4.8	0.01	+0.73	1.40	--	0.69	1.0	--
	8.5-18.0	72.5	20.3	7.2	Sandy Loam	--	4.8	0.01	-0.31	0.29	--	0.01	1.0	--
	18.0-28.0	76.5	15.8	7.7	Loamy Sand	--	4.6	0.01	-0.31	0.45	--	0.14	1.0	--
	28.0-31.5	50.9	35.7	13.4	Sandy Loam	--	3.4	0.12	-3.75	1.12	--	0.41	1.0	--
	31.5-37.0	7.6	62.4	30.1	Silty Clay Loam	--	2.7	0.47	+3.89	3.19	--	1.66	1.0	--
	37.0-41.0	15.4	54.3	30.3	Silty Clay Loam	--	4.3	0.23	+5.56	15.63	--	1.93	1.0	--
	41.0-49.0	50.0	36.4	13.6	Sandy Loam	--	5.5	0.02	+12.76	11.57	--	0.69	1.3	--
	49.0-58.5	74.0	18.3	7.6	Sandy Loam	--	3.3	0.05	+1.73	3.20	--	0.69	1.0	--
	58.5-66.5	48.6	35.9	15.6	Loam	--	3.7	0.12	-3.75	5.45	--	0.55	1.0	--
	66.5-75.0	40.5	40.0	19.6	Loam	--	4.1	0.07	-1.42	5.73	--	1.10	1.0	--
	75.0-84.5	94.9	2.5	2.6	Sand	--	5.1	0.02	-0.63	0.56	--	0.01	1.0	--
	84.5-89.5	81.4	9.9	8.7	Loamy Sand	--	2.3	0.11	-3.44	1.12	--	0.69	1.0	--
	89.5-95.0	87.4	6.0	6.6	Loamy Sand	--	3.4	0.05	-1.56	0.82	--	0.28	1.0	--
	95.0-103.0	61.3	27.4	11.2	Sandy Loam	--	2.8	0.07	-2.19	2.09	--	0.55	1.0	--
	103.0-108.0	94.4	5.0	0.6	Sand	--	2.9	0.02	-0.63	0.30	--	0.41	1.0	--
	108.0-113.0	43.8	32.8	23.3	Loam	--	2.9	0.05	-1.56	3.16	--	0.83	1.3	--
	113.0-119.5	60.5	26.4	13.2	Sandy Loam	--	2.3	0.07	-2.19	2.52	--	0.83	1.0	--

TABLE 5 (Concluded)

Core Number	Depth (ft)	Particle Size Analysis (%) Sand	Particle Size Analysis (%) Silt	Particle Size Analysis (%) Clay	Textural Class	Water Holding Capacity (%)[a]	pH (Sat. Paste)	Total Sulphur (%)	Acid-Base Potential[b]	Tot. Exch. Bases (meq/100g)	CEC[a] (meq/100g)	OC (%)	P (ppm)	K (ppm)
	119.5-129.5	92.5	4.9	2.6	Sand	--	2.7	0.07	-2.19	0.51	--	0.41	1.0	--
	129.5-139.0	93.4	5.0	1.6	Sand	--	2.7	0.19	-0.63	0.67	--	0.97	1.0	--
6	2.0-10.0	66.3	13.3	20.4	Sandy Loam	--	4.6	0.02	-0.63	0.56	--	0.69	1.0	--
	10.0-17.5	49.4	28.1	22.5	Sandy Clay Loam	--	4.7	0.10	-0.31	3.10	--	0.41	1.0	--
	17.5-24.0	67.6	9.2	23.2	Sandy Loam	--	5.1	0.01	-0.31	2.32	--	0.01	2.5	--
	24.0-29.0	33.5	26.3	40.3	Loam	--	4.6	0.01	+0.46	11.09	--	0.55	1.0	--
	29.0-37.5	35.2	28.2	36.6	Clay Loam	--	2.2	2.68	-50.31	13.55	--	9.38	1.0	--
	37.5-44.0	66.2	11.2	22.6	Sandy Loam	--	3.0	0.16	-1.25	1.52	--	1.24	1.0	--
	44.0-52.5	24.7	29.8	45.5	Clay Loam	--	2.7	1.28	-13.75	4.52	--	4.97	1.0	--
	52.5-59.0	55.6	20.1	24.3	Sandy Clay Loam	--	3.2	0.07	-2.19	1.04	--	0.69	1.0	--
	59.0-69.0	60.5	11.2	28.3	Sandy Loam	--	3.6	0.07	-2.19	0.77	--	0.76	1.0	--
	69.0-77.0	63.8	22.5	13.7	Sandy Clay Loam	--	4.0	0.05	-1.56	0.73	--	0.28	1.0	--
	77.0-85.0	81.0	3.6	15.4	Loamy Sand	--	3.8	0.02	-0.63	0.46	--	0.14	1.0	--
	85.0-95.0	77.1	7.6	15.3	Loamy Sand	--	2.4	0.16	-1.56	0.59	--	0.55	1.0	--
	95.0-104.5	65.1	11.3	23.6	Sandy Loam	--	4.0	0.13	-2.30	4.08	--	0.55	1.0	--
	104.5-114.5	67.5	5.2	27.4	Sandy Loam	--	7.1	0.09	+6.02	5.68	--	0.55	1.0	--
	114.5-117.0	53.1	9.3	37.7	Sandy Loam	--	3.9	0.24	-1.81	4.45	--	1.79	1.0	--
	122.0-124.0	83.4	6.6	10.1	Loamy Sand	--	3.9	0.02	-0.63	1.47	--	0.55	1.0	--
8	0.5-8.5	71.2	11.2	17.6	Sandy Loam	--	5.3	0.02	+0.38	2.23	--	0.55	1.0	--
	8.5-12.5	47.5	23.8	28.7	Loam	--	5.6	0.02	+1.62	8.94	--	0.28	1.0	--
	12.5-20.0	68.7	13.4	17.9	Sandy Loam	--	4.3	0.01	+0.70	3.91	--	0.14	1.0	--
	20.0-29.0	35.5	42.8	21.7	Clay	--	5.5	0.01	+1.45	13.82	--	0.28	1.0	--
	29.0-36.5	89.6	3.6	6.8	Sand	--	5.4	0.01	+0.46	1.04	--	0.10	1.0	--
	36.5-43.0	67.5	10.7	21.8	Sandy Loam	--	5.1	0.01	+0.95	6.19	--	0.28	1.0	--
	43.0-52.0	90.6	2.8	6.6	Sand	--	5.2	0.02	+0.26	0.79	--	0.01	1.0	--
	52.0-61.5	90.8	3.6	5.6	Sand	--	5.1	0.05	-0.55	0.68	--	0.01	1.0	--
	61.5-71.5	89.4	2.6	8.1	Sand	--	4.7	0.01	+0.46	1.19	--	0.97	1.0	--
	71.5-81.5	90.7	1.6	7.8	Sand	--	4.8	0.01	+0.19	0.92	--	0.01	1.0	--
	81.5-91.5	91.0	1.6	7.5	Sand	--	5.3	0.02	-0.38	0.83	--	0.01	1.0	--
	91.5-99.5	89.1	2.6	8.4	Sand	--	5.4	0.02	+0.14	0.94	--	0.14	1.0	--
	99.5-109.5	92.0	2.8	5.2	Sand	--	4.7	0.02	-0.38	0.92	--	0.01	1.0	--
	109.5-119.5	91.2	1.6	7.3	Sand	--	5.7	0.02	+0.14	0.89	--	0.14	1.0	--
	119.5-127.5	87.2	2.6	10.2	Sand	--	6.7	0.02	+0.63	1.12	--	0.14	1.0	--
	127.5-136.5	91.3	1.6	7.1	Sand	--	6.4	0.02	+0.63	0.99	--	0.28	1.0	--
	136.5-139.0	92.0	3.8	4.2	Sand	--	3.9	0.05	-1.06	1.01	--	0.14	1.0	--
	145.0-147.0	32.1	25.8	42.1	Loam	--	6.3	0.16	+6.26	39.02	--	14.9	1.0	--

[a] Information not available for the McClelland cores

[b] Tons $CaCO_3$ Equivalent/1,000 Tons

Source: SWEPCO Laboratory Analyses

TABLE 6

SELECTED CHEMICAL PROPERTIES OF SEVEN OVERBURDEN CORES
McCLELLAND ENGINEERS 1980

Core Number	Depth (ft)	Potential Acidity	Neutralization Potential	Net Acidity - Alkalinity	Extractable Bases Na	K	Ca	Mg	Extractable Fe	Total Cu	Total Mn	Total Mn
		tons $CaCO_3$ equiv./1,000 tons			(meq/100g)				(ppm)			
1	0.5 - 10.5	0.31	0.00	-0.31	0.09	0.09	0.19	0.08	33	12	34	57
	10.5 - 16.0	0.31	0.00	-0.31	0.68	0.42	3.84	9.01	111	24	62	94
	16.0 - 23.0	5.00	6.83	+1.83	0.60	0.71	6.94	15.92	230	34	2215	226
	23.0 - 31.5	0.63	9.60	+8.97	0.46	0.16	4.19	0.58	36	11	780	102
	31.5 - 40.0	2.81	9.36	+6.55	0.54	0.26	4.69	0.84	101	15	390	104
	40.0 - 43.5	5.63	0.00	-5.63	0.23	0.13	0.52	6.02	244	10	167	83
	43.5 - 51.5	0.63	0.02	-0.61	0.08	0.05	0.20	0.99	12	5	68	49
	51.5 - 58.0	4.06	4.31	+0.25	0.23	0.33	8.03	6.46	277	14	385	96
	58.0 - 62.0	2.81	0.00	-2.81	0.16	0.13	9.76	3.39	357	6	66	71
	62.0 - 68.0	5.31	1.26	-4.05	0.17	0.23	6.20	3.28	239	8	120	85
	68.0 - 77.0	2.81	10.37	+7.56	0.24	0.26	6.41	4.05	73	9	495	92
	77.0 - 79.5	18.75	30.00	+11.25	0.42	0.50	14.60	7.10	408	15	460	114
	79.5 - 83.0	5.31	8.61	+3.30	0.30	0.17	9.38	5.88	387	11	214	141
	83.0 - 91.0	10.00	37.37	+27.37	0.33	0.28	7.21	4.81	447	15	1025	218
	91.0 - 97.0	11.25	27.25	+16.00	0.58	0.34	9.56	5.76	243	13	615	102
	97.0 - 101.0	15.00	0.52	-14.48	0.73	0.28	12.00	7.25	375	14	620	115
	101.0 - 106.0	2.50	0.00	-2.50	0.40	0.22	5.21	0.50	357	8	67	73
	106.0 - 115.0	10.00	20.25	+10.25	0.51	0.24	0.97	3.17	360	12	935	139
	115.0 - 121.0	2.81	6.58	+3.77	2.10	0.67	10.40	6.76	131	25	115	148
	121.0 - 127.5	5.00	10.12	+5.12	3.23	0.52	16.19	5.48	471	24	120	112
	132.0 - 133.0	2.19	11.88	+9.69	4.34	0.96	13.54	5.78	79	26	231	153
2	2.0 - 9.0	0.63	0.00	-0.63	0.97	0.20	0.75	6.00	271	13	59	96
	9.0 - 17.0	2.19	14.16	+11.97	1.83	0.21	7.89	8.59	37	14	360	109
	17.0 - 27.0	4.38	7.50	+3.12	1.20	0.23	9.94	7.42	37	13	186	95
	27.0 - 37.0	2.19	5.57	+3.38	0.51	0.15	7.42	4.07	22	9	157	76
	37.0 - 43.0	0.63	31.33	+30.70	0.23	0.10	5.42	2.36	23	6	218	71
	43.0 - 51.0	1.88	3.56	+1.68	0.40	0.24	6.92	3.26	43	9	260	80
	51.0 - 58.0	3.44	0.00	-3.44	0.43	0.14	6.62	3.28	144	7	128	110
	58.0 - 67.2	12.81	0.78	-12.03	1.07	0.43	12.21	6.74	378	17	88	119
	67.2 - 76.0	15.31	10.12	-5.19	1.16	0.36	12.24	14.26	241	17	200	117
	76.0 - 85.0	2.50	0.00	-2.50	0.32	0.04	3.73	1.76	139	5	49	57
	85.0 - 90.5	4.38	0.00	-4.38	0.45	0.12	0.83	2.33	139	23	76	53
	90.5 - 98.5	12.50	40.91	+28.41	0.80	0.32	5.89	3.73	447	11	995	227
	98.5 - 107.5	11.88	11.76	-0.12	2.27	0.23	17.12	7.67	324	12	230	88
	107.5 - 112.0	2.19	8.09	+5.90	2.39	0.44	8.84	5.53	92	25	145	156
	112.0 - 121.0	0.63	26.28	+25.65	1.45	0.20	4.26	2.45	55	11	360	89
	121.0 - 127.0	1.25	8.34	+7.09	2.04	0.29	5.78	2.82	86	14	285	117
	127.0 - 133.5	0.63	9.49	+8.86	2.99	0.14	5.21	2.81	75	14	380	118
	133.5 - 140.0	1.25	0.0	-1.25	4.06	0.40	7.44	3.64	57	17	267	120

TABLE 6 (Cont'd)

Core Number	Depth (ft)	Potential Acidity	Neutralization Potential	Net Acidity - Alkalinity	Extractable Bases				Extractable Fe	Total Cu	Total Mn	Total Mn
					Na	K	Ca	Mg				
		tons $CaCO_3$ equiv./1,000 tons			(meq/100g)				(ppm)			
3	1.0 - 11.0	0.31	0.00	-0.31	0.04	0.02	1.31	0.03	16	3	11	31
	11.0 - 19.0	0.31	0.00	-0.31	0.06	0.02	0.02	0.04	4	3	8	37
	19.0 - 28.0	0.31	0.02	-0.29	0.02	0.02	0.05	0.04	9	6	11	42
	28.0 - 37.0	0.31	0.00	-0.31	0.07	0.02	0.02	0.10	21	10	10	34
	37.0 - 45.5	0.31	0.00	-0.31	0.05	0.02	0.02	0.08	5	7	12	52
	45.5 - 50.0	3.75	0.00	-3.75	0.03	0.02	0.02	0.10	348	10	12	48
	50.0 - 61.0	18.13	0.00	-18.13	0.06	0.04	0.46	1.62	449	16	40	127
4	0.5 - 8.0	0.63	0.00	-0.63	0.29	0.18	0.10	1.36	164	10	36	55
	8.0 - 17.5	0.63	0.00	-0.63	1.01	0.24	0.29	2.70	386	13	105	86
	17.5 - 27.5	11.88	0.00	-11.88	0.74	0.30	0.75	4.91	340	12	69	163
	27.5 - 36.0	26.88	22.00	-4.88	0.04	0.73	8.21	8.04	351	12	730	205
	36.0 - 45.5	0.63	0.50	-0.13	0.21	0.13	0.52	1.50	381	6	69	60
	45.5 - 49.0	0.63	0.00	-0.63	0.08	0.08	0.07	0.29	76	4	24	44
	49.0 - 96.0	21.25	31.26	+10.01	0.07	0.15	0.86	3.37	363	9	495	375
	56.0 - 65.5	4.38	3.27	-1.11	0.10	0.18	0.52	2.16	227	15	185	150
	65.5 - 72.5	3.75	0.00	-3.75	0.02	0.02	1.11	0.26	501	10	30	75
	72.5 - 81.5	2.19	0.00	-2.19	0.02	0.02	0.02	0.16	218	4	26	66
	81.5 - 90.5	3.75	0.00	-3.75	0.02	0.02	0.02	0.14	145	3	11	53
	90.5 - 99.5	0.63	0.00	-0.63	0.04	0.02	0.02	0.13	169	3	10	41
	99.5 - 109.5	0.31	0.00	-0.31	0.11	0.02	0.09	0.20	32	3	13	40
	109.5 - 119.5	0.63	0.00	-0.63	0.11	0.02	0.13	0.26	94	4	11	55
	119.5 - 129.5	0.63	0.00	-0.63	0.12	0.02	0.13	0.23	72	3	36	45
	136.0 - 137.0	2.19	0.00	-2.19	0.67	0.40	0.61	3.55	231	31	38	320
5	0.9 - 8.5	0.31	1.04	+0.73	0.05	0.14	0.38	0.83	431	18	370	137
	8.5 - 18.0	0.31	0.00	-0.31	0.05	0.05	0.03	0.16	50	5	13	47
	18.0 - 28.0	0.31	0.00	-0.31	0.07	0.04	0.05	0.29	15	5	18	36
	28.0 - 31.5	3.75	0.00	-3.75	0.04	0.07	0.36	0.65	274	6	36	46
	31.5 - 37.0	0.94	4.83	+3.89	0.08	0.23	0.88	2.00	672	12	174	315
	37.0 - 41.0	7.19	12.75	+5.56	0.22	0.44	8.79	6.18	217	27	500	143
	41.0 - 49.0	0.63	13.39	+12.76	0.15	0.26	6.48	4.68	118	15	410	112
	49.0 - 58.5	1.56	3.29	+1.73	0.11	0.10	2.02	1.07	235	9	110	82
	58.5 - 66.5	3.75	0.00	-3.75	0.12	0.23	0.68	4.42	223	17	100	135
	66.5 - 75.0	2.19	0.77	-1.42	0.12	0.30	0.84	4.47	225	19	82	154
	75.0 - 84.5	0.63	0.00	-0.63	0.11	0.04	0.14	0.27	23	3	31	33
	84.5 - 89.5	3.44	0.00	-3.44	0.06	0.02	0.21	0.83	346	4	40	50
	89.5 - 95.0	1.56	0.00	-1.56	0.08	0.04	0.14	0.56	58	2	32	48
	95.0 - 103.0	2.19	0.00	-2.19	0.07	0.06	0.34	1.62	300	6	45	77
	103.0 - 108.0	0.63	0.00	-0.63	0.02	0.02	0.04	0.22	162	2	27	45
	108.0 - 113.0	1.56	0.00	-1.56	0.10	0.21	0.39	2.46	238	8	59	89
	113.0 - 119.5	2.19	0.00	-2.19	0.09	0.12	0.45	1.86	271	6	42	70
	119.5 - 129.5	2.19	0.00	-2.19	0.01	0.01	0.13	0.36	152	4	15	49
	129.5 - 139.0	0.63	0.00	-0.63	0.08	0.02	0.13	0.44	198	2	21	49

TABLE 6 (Concluded)

Core Number	Depth (ft)	Potential Acidity	Neutralization Potential	Net Acidity - Alkalinity	Extractable Bases				Extractable Fe	Total Cu	Total Mn	Total Mn
		tons CaCO$_3$ equiv./1,000 tons			Na	K	Ca	Mg	(ppm)			
					(meq/100g)							
6	2.0 - 10.0	0.63	0.00	-0.63	0.04	0.06	0.11	0.35	138	5	36	53
	10.0 -17.5	0.31	0.00	-0.31	0.14	0.13	0.19	2.64	207	8	38	136
	17.5 - 24.0	0.31	0.00	-0.31	0.08	0.10	0.52	1.62	474	11	170	120
	24.0 - 29.0	0.31	0.77	+0.46	0.27	0.28	5.04	5.50	391	14	610	116
	29.0 - 37.5	50.31	0.00	-50.31	0.02	0.08	7.23	6.22	1497	26	85	135
	37.5 - 44.0	1.25	0.00	-1.25	0.07	0.05	0.41	0.99	204	8	20	43
	44.0 - 52.5	13.75	0.00	-13.75	0.09	0.14	0.76	3.53	448	17	40	104
	52.5 - 59.0	2.19	0.00	-2.19	0.05	0.06	0.27	0.66	195	8	41	97
	59.0 - 69.0	2.19	0.00	-2.19	0.05	0.07	0.18	0.47	104	6	34	61
	69.0 - 77.0	1.56	0.00	-1.56	0.07	0.09	0.14	0.43	42	7	16	53
	77.0 - 85.0	0.63	0.00	-0.63	0.10	0.05	0.08	0.23	27	5	14	34
	85.0 - 95.0	1.56	0.00	-1.56	0.02	0.02	0.11	0.44	382	5	24	61
	95.0 - 104.5	4.06	1.76	-2.30	0.19	0.15	0.57	3.17	185	8	160	110
	104.5 - 114.5	2.81	9.01	+6.02	0.24	0.15	2.49	2.80	174	8	310	96
	114.5 - 117.0	4.06	2.25	-1.81	0.14	0.17	0.76	3.38	316	9	185	98
	122.0 - 124.0	0.63	0.00	-0.63	0.10	0.08	0.37	0.92	90	4	41	57
8	0.5 - 8.5	0.63	1.01	+0.38	0.07	0.11	0.50	1.55	310	12	500	141
	8.5 - 12.5	0.63	2.25	+1.62	0.20	0.34	0.98	7.42	393	15	205	100
	12.5 - 20.0	0.31	1.01	+0.70	0.11	0.14	0.91	2.75	86	9	34	72
	20.0 - 29.0	0.31	1.76	+1.45	0.19	0.27	6.19	7.17	89	15	70	135
	29.0 - 36.5	0.31	0.77	+0.46	0.06	0.05	0.02	0.73	20	4	41	75
	36.5 - 43.0	0.31	1.26	+0.95	0.10	0.64	3.17	2.28	111	9	57	91
	43.0 - 52.0	0.63	0.89	+0.26	0.05	0.04	0.27	0.43	16	3	37	60
	52.0 - 61.5	1.56	1.01	-0.55	0.05	0.04	0.32	0.27	25	3	32	55
	61.5 - 71.5	0.31	0.77	+0.46	0.09	0.05	0.44	0.61	54	7	34	53
	71.5 - 81.5	0.31	0.50	+0.19	0.04	0.03	0.37	0.48	27	3	32	67
	81.5 - 91.5	0.63	0.25	-0.38	0.05	0.03	0.30	0.45	20	3	33	60
	91.5 - 99.5	0.63	0.77	+0.14	0.07	0.04	0.32	0.51	30	3	42	64
	99.5 - 109.5	0.63	0.25	-0.38	0.06	0.03	0.35	0.48	24	3	41	68
	109.5 - 119.5	0.63	0.77	+0.14	0.08	0.04	0.31	0.46	28	3	38	67
	119.5 - 127.5	0.63	1.26	+0.63	0.1	0.04	0.48	0.50	167	4	61	72
	127.5 - 136.5	0.63	1.26	+0.63	0.05	0.03	0.45	0.46	80	4	73	84
	136.5 - 139.0	1.56	0.5	-1.06	0.15	0.02	0.32	0.52	175	3	145	88
	145.0 - 147.0	5.0	11.26	+6.26	3.65	0.49	20.93	13.95	319	19	73	68

Source: SWEPCO Laboratory Analysis.

TABLE 7

PHYSICAL AND CHEMICAL PROPERTIES OF AN OVERBURDEN CORE IN THE AREA OF INITIAL MINING CLECO/SWEPCO 1982

Depth (ft)	Particle Size Analysis (%)			Textural Class	Water Holding Capacity (%)	pH (Saturated Paste)	Total Sulfur %	Acid-Base Potential[a]	Total Exch. Bases	CEC	OC %	Available P (ppm)	Available K (ppm)
	Sand	Silt	Clay						(meq/100g)				
0 - 3.5	79	20	1	Loamy Sand	6.2	6.2	0.06	-1.86	0.7	2.4	0.27	7.2	50
3.5 - 9.0	70	16	14	Loamy Sand	5.8	4.9	0.09	-2.81	0.9	7.6	0.01	7.7	72
9.0 - 18.0	90	6	4	Sandy Loam	3.2	5.0	0.03	-0.94	0.4	2.5	0.01	6.8	26
18.0 - 27.0	93	5	2	Sand	1.8	5.4	0.01	-0.31	0.3	1.1	0.01	7.2	22
27.0 - 39.0	93.4	6.5	0.1	Sand	1.8	5.5	0.03	-0.94	0.4	0.8	0.01	7.9	20
39.0 - 44.0	71	20	9	Sandy Loam	7.8	5.1	0.06	-1.88	1.4	3.6	0.01	8.0	50
44.0 - 46.5	71	21	8	Sandy Loam	6.4	5.1	0.01	-0.31	1.3	5.5	0.07	8.5	56
46.5 - 49.5	61	29	10	Sandy Loam	8.5	5.1	0.01	-0.31	2.6	6.9	0.01	7.7	69
49.5 - 57.0	85	8	6	Loamy Sand	4.0	5.6	0.06	-1.88	1.3	2.1	0.01	7.7	39
57.0 - 68.5	90	7	3	Sand	2.8	5.8	0.03	-0.94	0.9	1.8	0.01	7.7	31
68.5 - 71.5	80	14	6	Sandy Loam	6.5	5.2	0.06	-1.86	1.6	3.1	0.07	6.0	53
77.0 - 81.0	23	56	21	Silt Loam	16.2	5.8	0.09	+0.75	9.5	12.9	1.54	21.8	183
81.0 - 84.0	70	19	11	Sandy Loam	10.4	6.2	0.03	+2.26	5.1	7.8	0.27	49.4	126

Source: SWEPCO Laboratory Analyses.

[a] Tons $CaCO_3$ equiv./1,000 tons.

APPENDIX D

Draft Memorandum of Agreement (MOA)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

October 20, 1982

Mr. Lou Walls
Advisory Council on Historic Preservation
730 Simms Street, Room 450
Golden, CO 80401

Dear Mr. Walls:

EPA, Region 6, is presently preparing a Draft Environmental Impact Statement on the Dolet Hills Lignite Mine Project in DeSoto Parish, Louisiana. As a part of this environmental review for EPA's NPDES permit action on this project, we are requesting the Council's consultation in the development of the enclosed Proposal for Agreement. Comments should be submitted by COB November 3, 1982.

If there are any questions and for future coordination on this subject, please contact me or Joe Swick at 214-767-2716 or FTS 729-2716.

Sincerely yours,

Norm Thomas
Chief, EIS Preparation Section (6ES-FP)

Enclosure

cc: Robert DeBlieux, LASHPO
Jay Pruett, SWEPCO

Reproduced from best available copy.

Draft

PROPOSAL FOR AGREEMENT

I. EPA will incorporate by reference the following conditions into the original and appropriate subsequent NPDES permits to the Dolet Hills Mining Venture (DHMV) for a surface lignite mine in DeSoto Parish near Mansfield, Louisiana:

A. Prior to ground disturbing construction activities and mining, DHMV will complete intensive historic and cultural survey(s) to ensure the identification of all National Register or eligible properties that may be affected directly, or indirectly, by the subsequent mining and related activities, in accordance with the standards in 36 CFR Part 66 Appendix B (proposed guidelines)(copy attached). Generally, the intensive surveys will be conducted in coordination with 5-year permit areas. DHMV will develop an investigation strategy plan in consultation with the Louisiana SHPO, for review and approval. Unless the Louisiana SHPO notes an objection within 15 working days after receipt, the survey may proceed. If the SHPO notes an objection, the matter will be resolved before a survey proceeds.

B. DHMV shall provide sufficient documentation to the Louisiana SHPO about the historic and cultural properties identified by the survey(s) to enable the SHPO to assess the eligibility of the property for inclusion in the National Register of Historic Places. Site forms which include locational information shall be provided to the SHPO on a monthly basis as field survey work proceeds.

C. Should the Louisiana SHPO determine that a property does not meet the criteria for inclusion in the National Register, DHMV will identify the property on the detailed project plans and then no special protection need be afforded the property when encountered during construction or mining.

D. Should a property be found to meet the criteria for inclusion in the National Register, and where it is not possible to avoid or to protect it from subsequent construction and/or mine related activities, DHMV will, prior to any ground disturbing activity in the vicinity of the property, treat the property as follows:

1. If the property is significant (as documented in the nomination to or determination of eligibility for the National Register) primarily in the data it contains so that retrieval of the data in an appropriate manner may preserve this significance, DHMV, in consultation with the Louisiana SHPO, will develop and implement a data recovery program in accordance with the Council's Handbook for the Treatment of Archeological Properties (attached). DHMV will submit a data recovery plan to the Louisiana SHPO for review and approval prior to its implementation and prior to initiating any action that would affect the property. Unless the SHPO notes an objection within 15 working days after receipt, the plan may be implemented. If the SHPO notes an objection, the matter will be resolved before a plan is implemented.

Draft

2. If the property is significant (as documented in the nomination to or determination of eligibility for the National Register) primarily for architectural or historical values, DHMV will consult with the Louisiana SHPO to develop a mutually acceptable program which is to be implemented by DHMV to ensure preservation, relocation, and/or recordation of the property. If the property is to be relocated or otherwise rehabilitated and preserved, the mitigation program will conform to the Secretary of the Interior's Standards for Rehabilitation.

   Prior to demolition or alteration of any such property, DHMV will record the property so that there will be a permanent record of its present appearance and its history. DHMV will first contact the National Architectural and Engineering Record (NAER)(National Park Service, Department of the Interior, 5000 Marble Street, N.E., Albuquerque, New Mexico, 87110, or telephone 505-766-5944) to determine what documentation is required. All documentation must be accepted in writing by NAER prior to demolition or alteration of the property. DHMV will also provide copies of this documentation to the Louisiana SHPO.

E. DHMV will ensure that all survey, evaluation, data recovery, mitigation measures and monitoring will be conducted under the direct supervision of a person(s) who meet, at a minimum, the applicable professional qualifications set forth in 36 CFR Part 66 (proposed guidelines). DHMV's consulting archaeologist will be present during ground disturbing activities where it can be predicted that subsurface cultural material is likely to occur. DHMV's consulting archaeologist will train ground disturbing equipment operators to recognize cultural properties should any occur in areas where they were not previously predicted.

F. DHMV will stop activities that would adversely affect a historic or cultural property that is discovered during construction or mining related operations until the Louisiana SHPO has been given an opportunity to inspect the property, and whatever preservation or recovery measure that is agreed upon has been completed. Two working days should be allowed for this inspection.

G. DHMV will provide a draft copy of all reports to the Louisiana SHPO for review and comment. All reports of work accomplished will meet, in content and form, standards generally expected by historic preservation professionals as portrayed in proposed guidelines 36 CFR Part 66.

H. DHMV will provide at least two copies of final reports to the Louisiana SHPO. A copy of any final technical reports will also be furnished to Interagency Archeological Services (Department of the Interior, Washington, D.C. 20243) for possible submission to the National Technical Information Service (NTIS). Any precise locational data must appear in a separate appendix and will be withheld from NTIS publication pursuant to Section 11 of the General Authorities Act of 1970, as amended (Public Law 94-453). A copy of any final report will also be furnished to EPA.

Draft

DHMV will ensure that all notes, photographs, negatives, and processed data (tables, maps, etc.) will be stored in good order and in a manner that makes them available for future study at an appropriately accredited institution that meets the standards set forth in the proposed 36 CFR Part 66 and that makes these data available for other parties' research or other appropriate purposes.

II. Upon written notice from the Louisiana SHPO or the Council that any of the conditions of this agreement are being violated, EPA, the Louisiana SHPO and the Council shall consult to determine how the concern should be resolved.

III. If a signatory determines that the terms of this Agreement cannot be met or believes a change is necessary, the signatory shall immediately request the consulting parties to consider an amendment of the Agreement. Amendments will be executed in the same manner as the original Agreement.

Environmental Protection Agency (date)

Louisiana State Historic Preservation Officer (date)

Attachments-2

Index

I-0

INDEX

Acid Rain 5-158

Agency Alternatives 1-1; 4-47; 4-51

Agency Coordination 6-1

Air Emissions 1-12; 5-59; 5-60; 5-61; 5-62
  Radioactive 1-12; 5-62; 5-63; 5-158
  Process Emissions 5-61
  Fugitive Emissions 5-60; 5-61; 5-87
  Particulates 5-60; 5-61

Air Quality 1-12; 5-56; 5-157
  No Action Alternative 5-60
  Construction Impacts 5-60
  Operations Impacts 5-61
  Ecological Impacts 5-60; 5-61
  Combined Impacts (Plant and Mine) 5-63

Alternatives 1-1; 4-1; 4-11
  No Action 4-1
  Siting Options 4-2
  Mining Systems 4-3
  Overburden Removal 4-4
  Lignite Loading 4-5
  Reclamation 4-8
  Waste Disposal System 4-10

Applicant (Description of) 3-2

Aquatic Ecology 1-15; 5-79; 5-88; 5-90; 5-97; 5-98; 5-158
  Important Species 5-100
  Threatened or Endangered Species 5-101
  No Action Alternative 5-102
  Construction Impacts 5-102
  Operations Impacts 5-103
  Combined Impacts (Plant and Mine) 5-106

Atmospheric Dispersion Modeling 5-59

Biological Assessment (Section 7) 1-14; 3-3; 5-92; 6-1

Bottomlands 5-76; 5-77; 5-83; 5-90; 5-95; 5-158

Clean Air Act 3-3

Climatology 5-56; 5-57

Community Services and Facilities 5-112; 5-120; 5-131; 5-139

Coordination 6-1

Cultural Resources 1-15; 5-106; 5-163
  No Action Alternative 5-109
  Construction Impacts 5-109
  Operations Impacts 5-110
  Combined Impacts (Plant and Mine) 5-110

Cumulative Impacts 5-151

INDEX (Cont'd)

Demography 5-112; 5-117; 5-129; 5-135

Drainage and Erosion Control 4-29; Appendix B
  Sedimentation Ponds 4-29; 5-48; 5-50
  Diversion Structures 4-35; 5-48; 5-50

Dewatering 4-40

Ecologically Sensitive Habitats 5-81

Employment 5-111; 5-115; 5-125; 5-127; 5-159

Endangered Species Act (Section 7) 1-14; 3-3; 5-92; 6-1

Environmental Consequences of Proposed Project 1-4; 5-1

Erosion 5-18; 5-19; 5-84; 5-85

Executive Order 11990: Protection of Wetlands 3-3

Federal Water Pollution Control Act 3-1

Fish and Wildlife Coordination Act 3-4

Flood Protection 4-37

Flow Duration 5-39

Geology 1-9; 5-3
  No Action Alternative 5-5
  Construction Impacts 5-5
  Operations Impacts 5-6
  Combined Impacts (Plant and Mine) 5-6

Ground Water Hydrology 1-11; 5-23; 5-154
  No Action Alternative 5-28
  Construction Impacts 5-28
  Operations Impacts 5-28; 5-86
  Combined Impacts (Plant and Mine) 5-37

Heavy Metals 5-19; 5-35; 5-52

Housing 5-112; 5-121; 5-129; 5-135

Important Species
  Vegetation 5-80
  Wildlife 5-91
  Aquatic 5-100

Income 5-111; 5-117; 5-127

Land Use 1-18; 5-142; 5-162
  No Action Alternative 5-148
  Construction Impacts 5-148
  Operations Impacts 5-149
  Combined Impacts (Plant and Mine) 5-150

Leachate 5-35; 5-52

Lignite
  Extraction 4-5
  Transportation 4-7

INDEX (Cont'd)

  Reserves 4-21

Local Government Finances 5-113; 5-132; 5-141

Mining Sequence 4-22

Mining System
  Alternatives (Layout and Operation) 4-2; 4-3
  Preferred (Layout and Operation) 4-2; 4-4

National Historic Preservation Act (Section 106) 3-3

Need for Project 3-2

Noise, see Sound Quality

NPDES Permit 3-1; 3-3

Overburden 4-4; 5-14

PSD 5-59

Project Demand 3-2

Project Description (Preferred Alternative) 4-11
  Ancillary Facilities 4-15
  Mining Methods 4-25

Prime Farmland 5-10; 5-21; 5-151

Radioactive Emissions (see Air Emissions)

Reclamation 4-8; 4-44; 5-86; 5-96

Recreation Facilities and Aesthetics 5-115; 5-125; 5-134; 5-142

Red-cockaded Woodpecker 1-14; 5-92; 6-1

Revegetation 1-13; 4-47; 5-86; 5-96

Runoff 5-48; 5-50; 5-102; 5-105

Sanitary Waste Disposal 4-10; 5-54

Section 10/404 Permit (USCE) 3-3

Socioeconomics 1-16; 5-111; 5-159
  No Action Alternative 5-114
  Construction Impacts 5-115
  Operations Impacts 5-125
  Combined Impacts (Plant and Mine) 5-134

Soils 1-9; 5-7; 5-151
  No Action Alternative 5-18
  Construction Impacts 5-18
  Operations Impacts 5-19
  Combined Impacts (Plant and Mine) 5-22

Sound Quality 1-12; 5-64
  No Action Alternative 5-68
  Construction Impacts 5-68
  Operations Impacts 5-69
  Combined Impacts (Plant and Mine) 5-72

INDEX (Concluded)

Subsidence 5-2; 5-19

Surface Water Hydrology 1-10; 5-38; 5-156
    Hydrology 5-39; 5-48; 5-50; 5-55
    Water Quality 5-43; 5-49; 5-52; 5-56
    No Action Alternative 5-48
    Construction Impacts 5-48
    Operations Impacts 5-50
    Combined Impacts (Plant and Mine) 5-55

TSP 5-59

Threatened and Endangered Species
    Vegetation 5-80
    Wildlife 1-14; 5-92
    Aquatic 5-101

Topography 5-1
    No Action Alternative 5-1
    Construction Impacts 5-1
    Operations Impacts 5-2
    Combined Impacts (Plant and Mine) 5-3

Transportation Facilities 5-114; 5-123; 5-132; 5-141; 5-161

Vegetation 1-13; 5-73; 5-158
    Important Species 5-80
    Threatened and Endangered Species 5-80
    No Action Alternative 5-82
    Construction Impacts 5-82
    Operations Impacts 5-84
    Combined Impacts (Plant and Mine) 5-88

Waste Treatment Systems 4-10; 4-21; 5-54

Wetlands 5-78; 5-82; 5-85; 5-95; 5-158

Wildlife 1-14; 5-89; 5-158
    Important Species 5-91
    Threatened and Endangered Species 5-92
    No Action Alternative 5-93
    Construction Impacts 5-93
    Operations Impacts 5-95
    Combined Impacts (Plant and Mine) 5-97